TM 3-6665-205-10/2

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S MANUAL
SAMPLING AND ANALYZING PROCEDURES
SAMPLING AND ANALYZING KIT, CBR AGENT, M19

This copy is a reprint which includes current pages from Changes 2 and 3

HEADQUARTERS, DEPARTMENT OF THE ARMY
SEPTEMBER 1966

Change in force: C 2

TM 3-6665-205-10/2
*C 2

Change No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C., *25 May 1973*

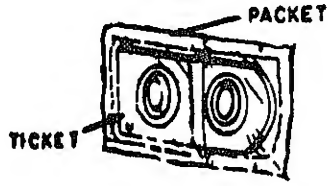
Operator's Manual
SAMPLING AND ANALYZING PROCEDURES
SAMPLING AND ANALYZING KIT, CBR AGENT, M19

TM 3-6665-205-10/2, 21 September 1966, is changed as follows:

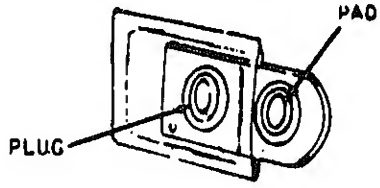
Page 2-5. Figure 2-2 is superseded as follows:

*This change supersedes C 1, 1 July 1969.

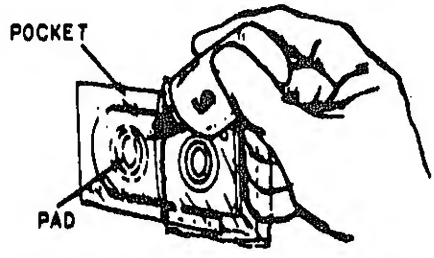
PREPARING TICKET FOR USE



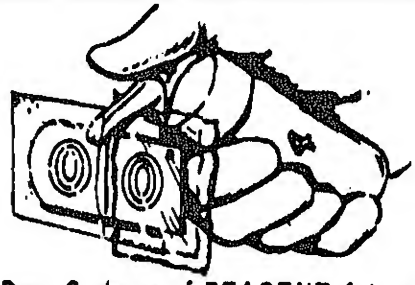
1. To open, tear the packet 1/2 inch from the round end of the ticket.



2. Push round end of the ticket from the packet.

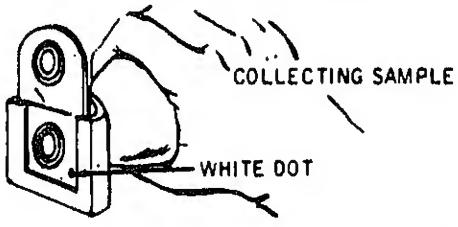


3 Place round end of ticket in pocket. Drop 2-drops of REAGENT 5 in pocket. Massage ticket in pocket until pad is uniformly wet.



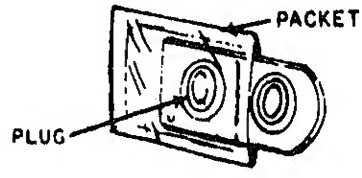
4. Drop 3-drops of REAGENT 4 in pocket. (Insert the spout in the pocket and carefully press the top of the dispenser.) Massage the ticket in the pocket.

5. The pad should turn blue within 3 minutes. If the pad does not turn blue, discard the ticket because it is spoiled. Using a fresh ticket each time, repeat the above procedure until a usable ticket is obtained. Discard the pocket.



6. Insert the square end of ticket (white dot away from the bulb) in the aspirator bulb adapter. Direct ticket toward ground. Slowly compress the bulb 10 times.

TESTING



7. Remove the ticket from the adapter. Place the square end of the ticket in the packet. Apply REAGENTS 5 and 4 as in steps 3 and 4.

8. Observe the color of the plug. If it is colorless or light red-orange, Anti- ChE material is present. If it is blue, no Anti-ChE material is present.

Figure 2-2. Procedure for Anti-ChE test (TEST 1).

Page 3-4. Paragraph 3-5 is superseded as follows:

3-5. Preparing Reagents for Use

a. REAGENTS 4, 5, 13, and 28 are ready for use.

b. Prepare REAGENTS 7 through 12, 14 through 26, 29, and 30 just prior to use.

(1) Loosen cap on squeeze bottle to relieve internal pressure.

(2) Compress walls of squeeze bottle slightly by squeezing. At the same time retighten the cap.

(3) Squeeze the bottle to crush all ampoules.

(4) Shake bottle vigorously for 15 to 30 seconds.

(5) Remove cap, invert bottle, and release 4 to 5 drops of solution from the tip.

(6) Recap the bottle tightly.

(7) Mark the date on the side of each bottle. Mark the cap with the letter "X".

c. Prepare REAGENT 6 as needed.

(1) Remove the cap and tip from the squeeze bottle.

(2) Fill the bottle half full with a alcohol from an alcohol tube. (The bottom of the tube is color-coded red.)

(3) Replace the tip. Invert the bottle and release 4 to 5 drops of solution from the tip. Screw he cap on tightly.

d. Prepare REAGENT 27 as needed.

(1) Remove the cap and tip from the squeeze bottle.

(2) Fill the bottle to its shoulder with distilled water. Use the graduated syringe to transfer the water from the water bottle to the squeeze bottle.

(3) Replace the tip. Invert the bottle and release 4 or 5 drops of solution from the tip. Screw the cap on tightly.

e. Prepare REAGENT 3 each day the kit is in use. Discard leftover reagent at the end of the day (24 hours), and wash the bottle thoroughly. Prepare REAGENT 3 as follows:

(1) Remove the cap and tip from the squeeze bottle.

(2) Place one tablet of REAGENT 1 and the contents of one packet of REAGENT 2 in the squeeze bottle.

(3) Crush the tablet by squeezing the walls of the bottle.

(4) Fill the squeeze bottle to its shoulder with distilled water from the plastic water bottle. (Use the graduated syringe to transfer the water from the plastic water bottle to the squeeze bottle.)

(5) Replace the tip. Invert the squeeze bottle and release 4 or 5 drops of solution from the tip. Screw the cap on tightly.

(6) Shake the squeeze bottle vigorously until little or no solids settle to the bottom.

Page 3-5, paragraph 3-6. Title is superseded as follows:

3-6. Checking Prepared Reagents

Subparagraphs *f*, *g*, and *m* are superseded as follows:

f. REAGENT 6 is filled with alcohol as needed. REAGENT 6 *is good indefinitely.*

g. REAGENT 7 is yellow solution. Disregard any white precipitate that forms on the bottom of the bottle. *Discard if the solution is red or deep orange.*

m. REAGENT 13 should match the neutral *blue-green* color of TEST 47, as shown on the direction cards.

Page 3-9, paragraph 3-8d (2). The last sentence is superseded as follows:

On the other hand, a strong base will hydrolyze the 2, 6-dichloroindophenyl acetate to indicate a false negative test (blue color) for nerve agent.

Page 3-30, Test 19 (DM), Specific Test for DM. Paragraph *a* is superseded as follows:

a. Procedure.

(1) Place a section of the outer ring in a test tube and add REAGENT 17.

(2) Heat for 2 minutes.

(3) Add REAGENT 12 and observe color change.

Paragraph *b* is added after paragraph *a*.

b. Interpretation.

(1) *Positive test.* Dark red, red-black, or yellow color (*c* below).

(2) *Negative test.* Any color other than that of a positive test indicates the absence of DM.

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-28 (qty rqr block No.1) operator maintenance requirements for Analyzing Kits.

CHANGE
NO. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *3 August 1978*

Operator's Manual
SAMPLING AND ANALYZING PROCEDURES
SAMPLING AND ANALYZING KIT, CBR AGENT, M19

TM 3-6665-205-10/2, 21 September 1966, is changed as follows:

Inside front cover. Add the following WARNING:

WARNING

Danger, Benzene is a Cancer Hazard. Avoid all skin contact. If benzene contacts skin, wash the contacted area with soap and water.

Page 3-1. Add the above WARNING between paragraph 3-1 and paragraph 3-1a.

By Order of the Secretary of the Army:

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-28, Operator maintenance requirements for Chemical Kits and Sets, Analyzing and Sampling.

TECHNICAL MANUAL
No. 3-6665-205-10/2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *21 September 1966*

OPERATOR'S MANUAL

SAMPLING AND ANALYZING PROCEDURES, SAMPLING AND ANALYZING KIT, CBR AGENT, M19 (U)

CHAPTER 1 (U)

GENERAL

Section I. INTRODUCTION

1–1. Scope

This manual is intended as a guide for use by personnel who have been trained to use the M19 CBR agent sampling and analyzing kit (fig. 1–1). It contains instructions for using the components as well as sampling and analyzing procedures. Each analyzing procedure (test) includes a test procedure, a detailed discussion of the chemistry of the test, chemical reactions, and an interpretation of the test results. A detailed description of the M19 kit and maintenance instructions are given in TM 3–6665–205–10/1.

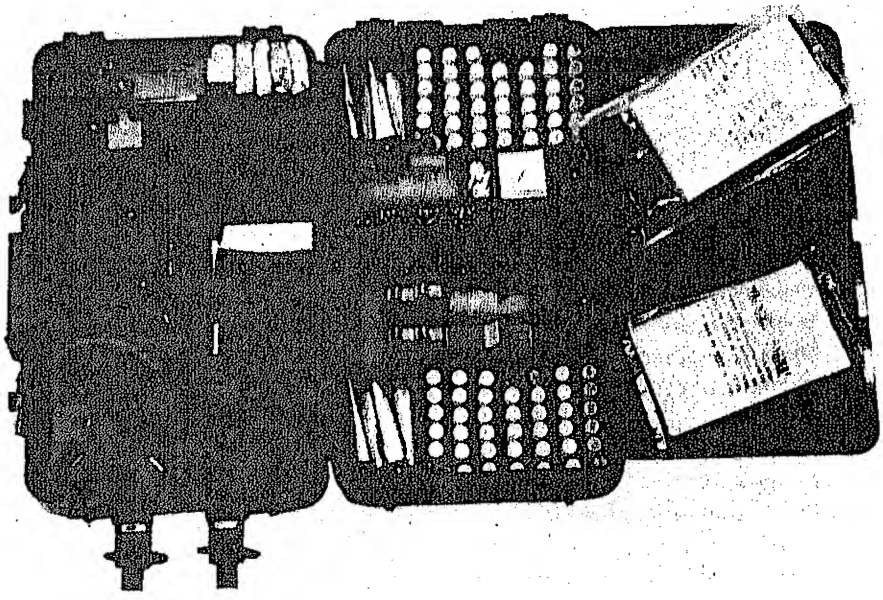


Figure 1–1 (U). M19 CBR Agent Sampling and Analyzing Kit (fully opened) (U).

1–2. Record and Report Forms

The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Publications) will be used for reporting these improvements. This form will be completed using pencil, pen, or typewriter and forwarded direct to: Commanding Officer, U.S. Army, Edgewood Arsenal, ATTN: SMUEA–TSE–TPE, Edgewood Arsenal, Md. 21010.

Section II. PURPOSE, DETECTING AND IDENTIFYING CAPABILITY, AND OPERABILITY OF KIT

1–3. Purpose

a. The M19 CBR sampling and analyzing kit (M19 kit) is intended for use by specially trained personnel in a technical intelligence team, a military intelligence team, or in a chemical service organization to:

(1) Detect and identify enemy chemical warfare agents.

(2) Perform preliminary processing of unidentifiable CBR samples.

(3) Delineate contaminated areas.

b. The kit is arranged so that each team member can use the kit to perform his assigned tasks without conflict of equipment needs.

c. All the members of the team must be skilled in the techniques of collecting and processing samples and performing the tests. One of the members of the team must have a chemical background in order to evaluate the chemical tests and translate the findings into the identification of known and unknown chemical agents. Individuals who do not have this background but who have had experience with the M18 series chemical agent detector kits and M10A1 chemical agent analyzing kit can evaluate tests with respect to the detection of known agents.

1–4. Detecting and Identifying Capability

The M19 kit provides the means for detecting and identifying known chemical agents and chemical agent functional groups listed below:

a. Specific Chemical Agents.

Anticholinestrase agents
V-agents
G-agents (GA, GB, GD, GF, etc.)
Mustard (HD)
Nitrogen mustard (HN–1, HN–2, HN–3)
Lewisite (L)
Phosgene (CG)
Phosgene oxime (CX)
Hydrogen cyanide (AC)
Cyanogen chloride (CK)
Bromobenzylcyanide (BBC)
Chloroacetophenone (CN)
Chloropicrin (PS)
Adamsite (DM)
Phenyldichloroarsine (PD)
Ethyldichloroarsine (ED)
Methyldichloroarsine (MD)
Diphenylchloroarsine (DA)
Diphenylcyanoarsine (DC)
H-sulfone
T-agent
Q-agent
W-agent (Toxic protein)
Selenium oxide (SeO_2)

b. Functional Groups (Chemical Agent).

Acetylides
Acylating
Alkylating
Cyanide ion (CN-)
Hydrolyzable flourine ion (F-)
Mercaptans (-SR)
Inorganic phosphata ion (PO_4)
Per-Acids
Reactive Methylene
Redox-Reactants
Some secondary amines
Most tertiary amines
Quaternary ammonium salts
Thioamides
Most heavy metals

1–5. Operability of Kit at Night and in Cold Weather

a. Components of the kit are color coded and marked with fluorescent paint so that the kit can be operated at night by using an ultraviolet lamp with a lighted viewing box to provide ultraviolet light. Colors under ultraviolet light are the same as they appear in daylight.

b. The sampling components of the kit will function at temperatures as low as −25° F. The analyzing components will function at temperatures ranging from 32° F. to 115° F.

CHAPTER 2 (U)

SAMPLING

Section I. INTRODUCTION

2–1. General

When called to investigate an incident:

a. Set up a center of operation in a sheltered uncontaminated area upwind of the suspected contamination.

b. Obtain and record in the field notebook all available information as to the time of incident, location and extent of contamination, weather condition, nature and number of casualties; and any other pertinent data which will serve as a guide in determining where to sample and what components will be needed to accomplish the sampling mission.

c. Select and prepare sampling components as described in paragraph 2–2. Be sure to carry writing materials (lead pencil or ballpoint pen, wax marking pencil, writing paper, and field notebook), filter paper disperser, and a book of ABC–M8 VGH chemical agent detector paper on each sampling mission.

d. Don a field protective mask and toxicological agents protective gloves over impregnated cotton gloves before entering any area suspected of being contaminated. If RW-Agent contamination is suspected, wear a dosimeter and carry a radiac survey meter.

e. Perform the screening and sampling as described in paragraphs 2–3 through 2–8.

f. Mark samples for identification with date, time, location, and sample number.

g. As soon as the sampling mission is completed, return to the center of operation (M19 kit) to process and analyze samples. (BW-Agent samples are forwarded as soon as possible to the nearest hospital that has a laboratory and RW-Agent and unidentifiable CW-Agent samples are forwarded to a base laboratory for analysis.)

2–2. Selection and Preparation of Sampling Components

a. For Air Sampling (CW-Agent Vapors, Aerosols, and Smokes). Remove the vapor kit from the M19 kit. Prepare it for use as described below and clip it to the belt at the left side of the body. Always use the coated tip forceps to handle combination filters and Dragendorff paper.

(1) Remove one of the air samplers from the vapor kit. Do not remove the caps (1, fig. 2–1) and (5) from the ends of the sampler. Disconnect the air inlet adapter (2) and the air outlet adapter (4) from the body (3).

(2) Using the detector tube seal breaker (B) break off the ends of the following detector tubes and insert the uncoded ends of the tubes in the sampler as shown in D.

1—single green band
1—single yellow band
1—single red band
2—single blue band
3—single white band
1—double yellow band
1—double green band

Note. Prior to use, check the color of the gel in the unexposed single red and green band detector tubes against the color standard on the direction card to determine if they should be used or discarded.

(3) Remove a combination filter packet (Green X) from the M19 kit. Pull down on the attached string to open the packet. Remove the paper from packet with the coated tip forceps and insert it in the sampler as shown in A.

Note. If only smoke or aerosol samples are to be collected omit (2) above and leave detector tube openings empty.

(4) Connect the air inlet and the air outlet adapters to the body and return the sampler to the vapor kit.

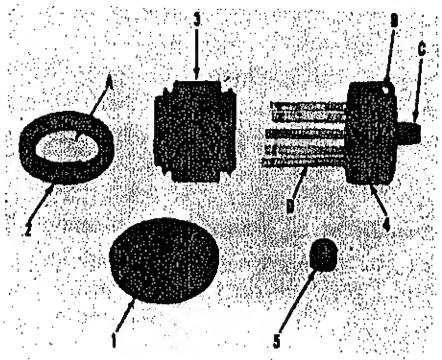
(5) Remove the second air sampler and the dummy plugs from the vapor kit and using the same procedure as given in (1) through (3) above, insert 2 single blue band and 6 single white band detector tubes and either a combination filter paper or a Dragendorff paper (packet marked with a red D). Use the coated tip forceps when handling the Dragendorff paper to avoid contaminating the paper.

(6) Fill unused detector tube openings in the sampler with dummy plugs and arrange the unused dummy plugs within the circle of detector tubes.

(7) Reassemble the air sampler and return it to the vapor kit.

(8) Place the aspirator bulb assembly and REAGENTS 4, 5, 13, and 27 in the vapor kit.

(9) When additional samples are required, prepack additional sets of detector tubes (para (2) and (5) above), combination filters, and Dragendorff papers in shipping envelopes and place them and the coated tip forceps in the vapor kit.



1 Cap
2 Air inlet adapter
3 Body
4 Air outlet adapter
5 Cap

A—Combination filter
B—Detector tube seal breaker
C—Air outlet
D—Detector tubes

Figure 2-1 (U). Air sampler (U).

(10) Mount the vacuum pump at the waist on the right side of the body.

(*a*) Loosen the wingnuts which hold the vacuum pump assembly in the case.

(*b*) Support the pump against the body so that the D-ring and the buckle opposite it are parallel with the waist and the buckle adjacent to the D-ring points upward.

(*c*) Pass the body strap around the waist and thread it through the buckle and adjust the strap to fit comfortably.

(*d*) Pass the shoulder strap over the right shoulder, diagonally across the back, under the left arm, and across the front of the body and thread it through the buckle which is adjacent to the D-ring. Adjust the strap to fit comfortably.

(*e*) Pass the rubber tubing which is connected to the intake fitting of the pump under the right arm, across the back and over the left shoulder. Tuck the free end under a strap until ready for use.

b. For Soil, Surface, and Water Sampling. Remove a soil kit from the M19 kit and prepare it for use as described below, and clip it to the belt at the left side of the body. Stow the items removed from the soil kit in the M19 kit.

(1) *For CW-agent soil or surface sampling.* Remove all of the items in the soil kit except the scoop, 2 soil collection bags, 2 soil extraction bags, 4 shipping tags, 4 wire ties, 2 extraction fluid bottles, and 8 applicators. Place the speciman forceps from the M19 kit into the soil kit.

(2) *For CW-agent water sampling only.* Remove all the items in the soil kit except the 6 soil collection bags, 3 shipping tags, and 6 wire ties.

(3) *For BW-Agent soil, surface, or water sampling.* Remove all of the items in the soil kit with the exception of the scoop, 2 applicators, 2 soil collection bags, 6 wire ties, and 6 shipping tags. Place the specimen forceps, 2 swab liquid vials (blue cap) and 2 empty vials (red cap) from the M19 kit into the soil kit.

(4) *For RW-agent sampling.* Remove all the items of the soil kit with the exception of 3 soil extraction bags, 3 radiation hazard tags, and 3 wire ties, and 3 shipping tags.

Note. In addition to the soil kit the operator must be equipped with a personal dosimeter and a radiac survey meter.

Section II. SCREENING SUSPECTED AREAS

2–3. General

In all probability, the intelligence team will reach the area after a suspected CBR attack has taken place.

a. If intelligence reports indicate that CBR agent may have been delivered by aircraft or missile spray, screen the area known to have been in the path of the spray before collecting samples. Avoid screening areas that are shielded by obstructions and surfaces which are exposed to direct sunlight and high temperatures.

Note. For purposes of this manual, persistent agents are those agents which are effective in either liquid or solid form at the point of release for a period of more than 10 minutes under field conditions. Nonpersistent agents are those agents which are effective in vapor or aerosol form at point of release for a period of less than 10 minutes under field conditions.

b. Survey suspected area with a radiac survey meter. If survey meter indicates radioactivity, locate and isolate hot spots and record time, location, and radiation intensity. Collect RW-agent samples (para 2–8).

c. Scan the suspected area for sources of suspected CW- or BW-agent contamination such as:

(1) Oily drops, liquid splashes, gelatinous masses, particles of powder or solids on surfaces, vegetation, ground, and in craters.
(2) Oily or fluorescent streaks or dark coloration on water or on hard surfaces.
(3) Wet stains or haze on porous surfaces.
(4) Debris in shell or bomb craters.
(5) Enemy ammunition components, aerosol dissemination equipment, spray guns, flasks, vials, unusual types of bombs or shells (compressed air type).
(6) Wilted or discolored plants or flowers, unusual number of dead animals or fish.

d. Screen suspected sources (*c* above) as described in paragraph 2–4.

e. Collect CBR samples, as described in paragraphs 2–6 through 2–9.

2–4. Screening

The screening methods described below are intended to locate and confirm the presence of gross CW-agent contamination. If the presence of CW-agent is not confirmed after screening all suspected sources, collect samples from two or three of the suspected sources for CW-agent and possible BW-agent analysis.

a. M8 Detector Paper. M8 detector paper detects H, G, and V agent. (Some gasolines, diesel fuels, organic solvents, and cleaning solutions may give false positive tests.)

(1) Tear out a sheet of M8 detector paper from the book.
(2) Hold it in contact with suspected source for approximately 10 seconds. (For suspected water, put a drop of the water on the paper.)
(3) Note any color change and compare with colors printed on the inside cover of the book.
(*a*) A yellow color indicates G-agent.
(*b*) A red color indicates Mustard (H).
(*c*) A green color indicates V-agent.
(*d*) No apparent color change indicates either no agent or a concentration of agent too low to be detected with the M8 detector paper.

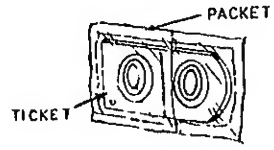
b. Anticholinesterase Detector Ticket. Use an anticholinesterase detector ticket (packet with a Green E) to detect anti-ChE material on surfaces in water and in the atmosphere. The procedure given in figure 2–2 is used to detect Anti-ChE material in the atmosphere.

Note. Take sample downwind within 6 inches of suspected source.

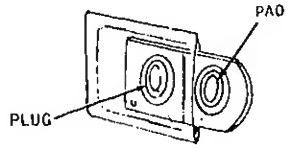
c. Dragendorff Paper. Use the Dragendorff paper if both the M8 detector paper and the Anti-ChE detector ticket give positive tests.

(1) Remove a Dragendorff paper from a packet (red D). Do not bend the paper because it may be brittle. Use the coated tip forceps to handle the paper.
(2) Inspect the paper. The color of the paper should be yellow. If

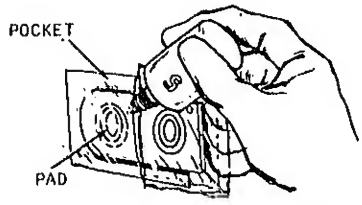
PREPARING TICKET FOR USE



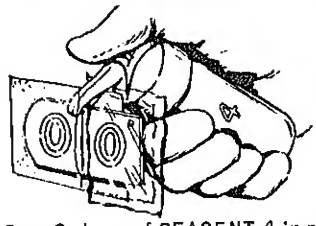
1. To open the packet, pierce with a corner of the square end of the ticket.



2. Remove the ticket from the packet and reinsert square end of the ticket in the packet. Do not touch the pad or the plug.

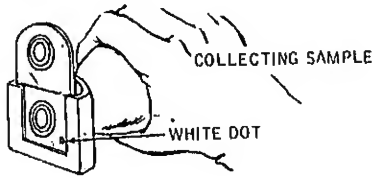


3 Place round end of ticket in pocket. Drop 2-drops of REAGENT 5 in pocket. Massage ticket in pocket until pad is uniformly wet.



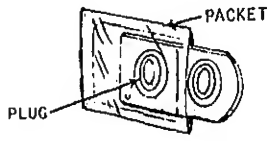
4. Drop 3-drops of REAGENT 4 in pocket. (Insert the spout in the pocket and carefully press the top of the dispenser.) Massage the ticket in the pocket.

5. The pad should turn blue within 3 minutes. If the pad does not turn blue, discard the ticket because it is spoiled. Using a fresh ticket each time, repeat the above procedure until a usable ticket is obtained. Discard the pocket.



6. Insert the square end of ticket (white dot away from the bulb) in the aspirator bulb adapter. Direct ticket toward ground. Slowly compress the bulb 10 times.

TESTING



7. Remove the ticket from the adapter. Place the square end of the ticket in the packet. Apply REAGENTS 5 and 4 as in steps 3 and 4.

8. Observe the color of the plug. If it is colorless or light red-orange, Anti- ChE material is present. If it is blue, no Anti-ChE material is present.

Figure 2-2 (U). Procedure for Anti-ChE test (TEST 1) (U).

the paper is flecked with black or is orange black, or brown, do not use it. (See TEST 6 for explanation.)

(3) Apply the paper to the suspected surface for approximately 10 seconds. If the suspected source is water, omit (4) below.

(4) Wet paper with REAGENT 27 (water).

(5) Inspect the paper for color change:

(*a*) Any red orange or brown red color confirms presence of agent. (Some decontaminating solutions may give a red-brown color.)

(*b*) If the paper remains yellow, the test is negative.

d. Filter Paper Strip.

(1) Tear off a strip of filter paper (filter paper dispenser) approximately 2 inches long.

(2) Place 2 drops of REAGENT 13 on the paper. The reagent will color the paper green.

(3) Holding one end of the paper, bring it in contact with the suspected source. Keep the paper in contact for approximately 10 seconds.

(4) Remove the paper and inspect it for color change.

(*a*) A yellow color indicates contamination is acidic.

(*b*) A blue color indicates contamination is basic.

(*c*) A green color indicates no test or possibly a neutral agent.

Section III. COLLECTING CBR SAMPLES

2–5. General

Collect all CBR samples that may be required and mark them for identification with date, time, location, and sample number.

2–6. CW-Agent Samples

a. Vapor Samples.

(1) Vapor samples are generally collected as described in paragraphs *b* or *c* below.

(2) If the suspected agent has a very low vapor pressure or if the temperature is near freezing, or if the wind velocity is 7 miles per hour or above, concentrate the vapors before collecting samples.

(*a*) Cut an opening approximately 2½ inches in diameter in the bottom of an empty can (or box).

(*b*) Place the can (bottom up) over the suspected area. Cover the opening and allow the vapors to concentrate in the can for approximately 5 minutes.

(*c*) Remove the cover and collect the sample as described in paragraph *b* or *c* below.

Caution: **Insert the end of the sampling device just inside of the opening in the can. Do not permit the sampling device to touch the contaminated source.**

(3) If the suspected agent has a low vapor pressure and the temperature is freezing or below, collect a soil sample as described in *c* below and collect vapor samples as described in paragraph 2–11.

b. Individual Vapor Samples. Use the aspirator bulb assembly when conditions are such that only individual vapor samples are required.

(1) Select appropriate detector tubes.

(2) Break off the sealed ends of the selected detector tube.

(3) Insert the uncoded end of the tube in the opening in the aspirator bulb assembly.

(4) Compress the bulb at the rate of 30 to 40 compressions per minute allowing the bulb to fully inflate after each compression. The following is the minimum number of compressions required for CW-agent sampling:

(*a*) G-type agents and CK (BLUE BAND TUBE)—50 compressions.

(*b*) H, HD, HT, HN, CX, and PS (BLUE BAND TUBE)—10 compressions.
(*c*) L, ED, MD (YELLOW BAND (double) TUBE)—12 compressions.
(*d*) L (YELLOW BAND (single) TUBE)—12 compressions.
(*e*) CG (GREEN BAND (single) TUBE)—5 compressions.
(*f*) CN, BBC (GREEN BAND (double) TUBE)—12 compressions.
(*g*) AC, GA (RED BAND TUBE)—5 compressions.
(*h*) Nerve Agents, Unknown Agents (WHITE BAND TUBE)—75 compressions.

c. Multiple Vapor, Smoke, or Aerosol Samples. Both air samplers (para 2–2*a*) are used at the same location to collect a complete set of samples.

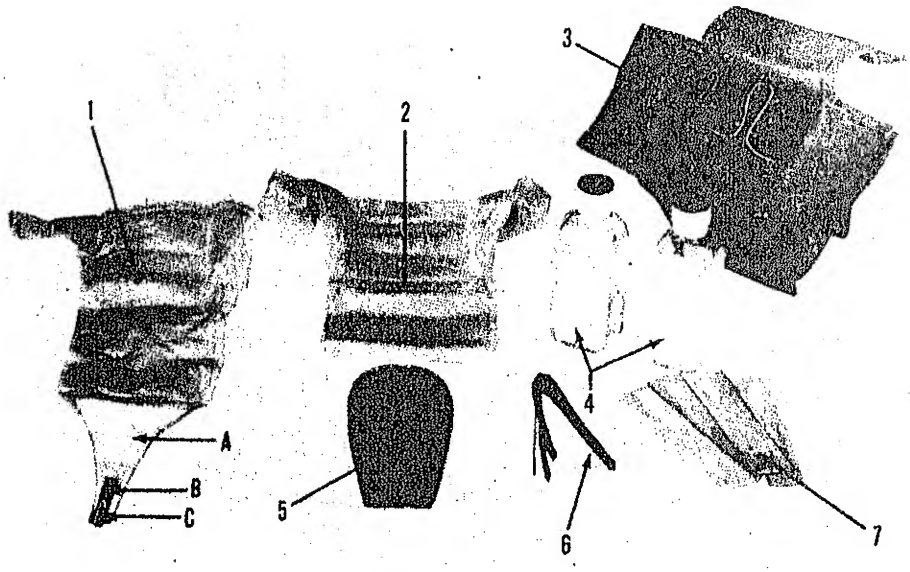
(1) Remove the rubber caps from the ends of a loaded air sampler and attach the air sampler to the rubber tubing on the vacuum pump.
(2) Unfold the vacuum pump handle.
(3) Hold the air sampler in the left hand. Hold the sampler approximately 6 inches above and downwind of the source. Do not allow the sampler to come in contact with liquid agent or soil.
(4) Crank the vacuum pump handle clockwise at the rate of approximately 60 revolutions per minute. Crank the handle 18 revolutions for each detector tube in the sampler. (For example, if the sampler is loaded with 10 detector tubes, crank the handle 18×10 or 180 revolutions or for approximately 3 minutes.) For smoke samples only, (no detector tubes in sampler) crank the handle 120 revolutions or for approximately 2 minutes.
(5) Detach the air sampler from the rubber tubing, cap the ends and return it to the vapor kit.
(6) If more than one set of samples are required:
(*a*) Remove the detector tubes and filters from the air sampler and place them in a shipping envelope.
(*b*) Reload the air samplers (para 2–2*a*).
(*c*) Repeat the above sampling procedures.

d. Soil Samples.

(1) Unroll a soil extraction bag (1, fig. 2–3) and remove the paper clip (C) and spacer (B).
(2) Fold up the bottom of the bag 3 times and fasten the fold with the paper clip.
(3) Scoop a thin layer (not more than ½ inch) of top soil from a small area into the bag. Do not fill the bag more than ¼ full.
(4) Fold down the top of the bag 3 times and seal the bag with the ties (6).
(5) Place the sample in the soil kit.
(6) Discard the scoop after all samples have been collected.

e. On Surfaces. Remove the seal and cap from an extraction fluid bottle (4, fig. 2–3) and, using a fresh applicator (7) each time, repeat the following procedure 4 times:

(1) Dip an applicator into the bottle to wet it.
(2) Roll or rub the tip over a small area of the surface.
(3) Place the applicator tip in the extraction fluid bottle and snap off the upper part of the applicator.



1	Soil extraction bag	6	Ties
2	Soil collection bag	7	Applicators
3	Carrier	A—Cotton filter	
4	Extraction fluid bottles	B—Paper spacer	
5	Scoop	C—Paper clip	

Figure 2–3 (U). Soil kit (U).

(4) When sampling is completed, recap the bottle and remove the tape from the side of the bottle and reseal the bottle with the tape.

Note. If contaminated foliage or twigs are used for sampling, handle them with the specimen forceps. Dip them in the extraction fluid several times and then discard them. Handle the foliage or twigs carefully to prevent them from falling into the liquid.

f. Water Sample. Use a soil collection bag and the scoop to collect water samples. Avoid debris in the water samples.

(1) Scoop approximately 55 milliliters (2 ounces) of suspected water into a soil collection bag.

(2) Fold down the top of the bag 3 times. Seal the bag with the attached ties.

(3) Wrap a tie (6) tightly around the bag approximately ¼ of the distance from the top of the bag.

(4) Rinse the outside of the bag with uncontaminated water and place the bag into a second soil collection bag and seal it in the same manner as the bag containing the sample.

2–7. BW-Agent Samples

If the presence of BW-agent is suspected, collect BW-agent samples. This will avoid having to reenter the contaminated area should a BW-agent analysis be required as indicated by TEST 22.

a. Water Sample.

(1) Remove the seal and cap (red) from an empty sterile vial.

(2) Dip the vial just below the water surface and fill the vial.
(3) Recap and reseal the vial.
(4) Rinse the outside of the vial with uncontaminated water.
(5) Mark a shipping tag to identify the sample and attach it with a tie to the vial.
(6) Place the vial in the soil kit.

b. On Surfaces.

(1) Remove the seal and cap (blue) from the swab liquid (holding solution) vial.
(2) Dip the cotton tip of an applicator into the swab liquid. Remove the applicator and recap the vial.
(3) Rub and roll the wetted applicator tip over the suspected surface covering an area of approximately 36 square inches.
(4) Open the vial, insert the cotton tip of the applicator, and break off the end that extends from the vial.
(5) Recap and reseal the vial.
(6) Mark a shipping tag to identify the sample and attach it with a tie to the vial.
(7) Place the vial in the soil kit.

2–8. RW-Agent Soil Samples

Collect an RW-Agent from a hot spot (para 2–3*b*).

a. Using the scoop, transfer a thin layer of soil, two or three inches square and ¼ to ⅜ inch deep, to a soil collection bag. (Fill the bag approximately half full.)

b. Fold down the top of the bag three times. Seal the bag with the attached ties.

c. Mark a shipping tag to identify the sample and attach it with a tie to the bag.

d. Place the sample in the soil kit. Then place the soil kit in a suitable shielded container as soon as possible.

e. Record hourly meter readings until the sample is shipped to the laboratory. Ship the readings along with the sample.

2–9. Contaminated Objects

a. Use a soil collection bag to collect small contaminated objects, such as fragments or parts of enemy ammunition components, aerosol dissemination equipment, spray guns, vials, compressed air type bombs or shells, small dead animals or fish.

b. Fold down the top of the bag three times. Seal the bag with the attached ties.

c. Mark a shipping tag to identify the sample and attach it to the bag.

d. Place the sample in the soil kit.

Section IV. PROCESSING CW-AGENT SOIL SAMPLES

2–10. General

To prevent the deterioration of CW-Agent in the soil sample, process the sample as soon as possible after it has been collected. If the soil sample was collected at below freezing temperatures (para 2–6*a*), collect a CW-Agent

vapor sample from the soil sample (para 2–11) before processing the sample (para 2–12) for preliminary analysis or for shipment to a laboratory for analysis.

2–11. CW-Agent Vapor Samples from Soil Sample

CW-Agent vapor samples are collected from a soil sample as described below.

a. Load the two air samplers as described in paragraph 2–2. Use a combination filter in each sampler to prevent soil particles from being drawn into the sampler and contaminating the sampler. Do not use the combination filter for test purposes. Repeat the following procedure with each air sampler.

b. Attach an air sampler to the free end of the rubber tubing on the vacuum pump.

c. Insert the air sampler in the soil extraction bag as shown in figure 2–4.

d. Hold the air sampler with the soil extraction bag around it and dip the bottom of the bag into a container of warm water. Hold the bag just below the surface of the water for two or three minutes.

e. Remove the bag from the water and wipe off the excess water.

f. Place the unit on a work surface, remove the clip and unfold the bottom of the bag. Insert an applicator in the bottom of the bag to hold it open. Collect vapor samples as described in paragraph 2–6*b*.

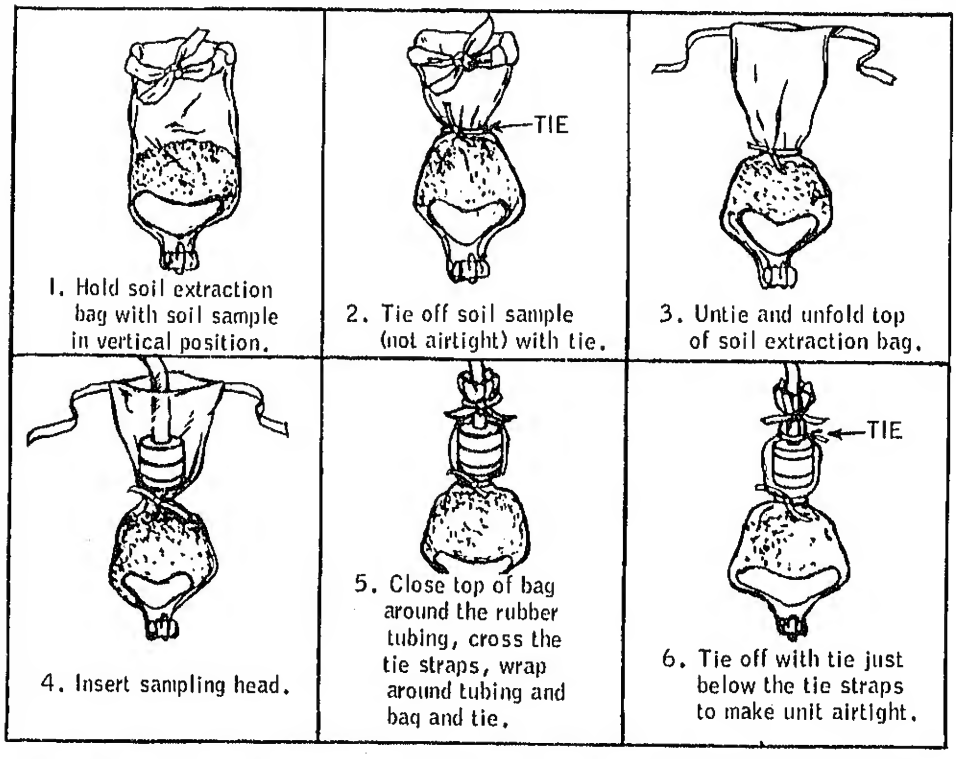


Figure 2–4 (U). Inserting air sampler in soil extraction bag containing soil sample (U).

2–12. Processing Soil Samples

a. Untie and unfold the top of the soil extraction bag.

b. Remove the seal and cap from the extraction fluid bottle.

c. Carefully pour the extraction fluid into the soil extraction bag leaving the solid drying agent in the bottle.

d. Reseal the top of the soil extraction bag.

e. Hold the seals at the top and bottom of the bag in one hand and gently knead the contents of the bag for approximately 3 minutes with the other hand. Do not squeeze out any of the contents.

f. Remove the clip. Unfold the bottom of the bag, and insert it in the extraction fluid bottle.

g. Gently squeeze the fluid from the bag into the bottle.

h. Remove the bag from the bottle and reseal the bottom of the bag.

i. Recap the extraction fluid bottle tightly and reseal the bottle. With the pressure sensitive tape on the side of the bottle, mark the bottle to identify the soil extract with the soil sample. (If preliminary tests are performed using some of the soil extract, the bottle need not be resealed until after the tests are performed.)

j. Place the soil extraction bag in a soil collection bag and seal the bag with the attached ties.

k. Place the processed soil sample and the extraction fluid bottle in the soil kit.

CHAPTER 3 (C)

ANALYSIS (U)

Section I (U) INTRODUCTION

3-1. General

a. Wear a protective mask and neoprene gloves when performing tests.

b. Even though the screening procedures (prior to sampling) and other supplemental information indicate the presence of a specific CW-agent, perform all of the tests because several CW-agents may have been used in combination, or the screening tests may not have been sufficiently sensitive to detect a low concentration of a CW-agent.

c. Perform tests in the order in which they are described unless directed otherwise. Do not rely on memory; record all test results (positive, negative, and doubtful) on a sheet from the field notebook (fig. 3–1) as soon as the observation is made. Use the following symbols to indicate the test results:

Symbols	*Meaning*
NA	Test not applicable or test not performed.
−	Test is negative.
+	Test is positive but weak.
++	Test is positive but strong.
?	Not certain whether test is positive or negative or could not readily determine. This symbol must be accompanied by further information under remarks.
B	Basic.
A	Acid.
N	Neutral or no color change.

d. The color in a given test may vary due to differences in concentrations, the presence of other agents, and impurities in the sample. The direction cards illustrate the test colors observed most often.

e. In some cases a weak positive color test may not be recognized unless it is compared to a blank. Until the operator is thoroughly familiar with the test colors and procedures, perform all blank tests as described in the test procedures.

f. Cleanliness, neatness and accurate dispensing of reagents are important factors in obtaining reliable results. Cotton swabs are provided for cleaning purposes. Take care to prevent the tips of reagent bottles from becoming contaminated. Wipe the tips of reagent bottles clean after each use; replace caps tightly on bottles and return them immediately to their proper position in reagent set. Clean test tubes after use (para 4–2). Items such as the smoke extractor, coated tip forceps, scissors, air samplers, plastic needle, test tubes, and alligator clips may become contaminated with agent during use. Set them aside, and clean them (para 4–3) before returning them to the kit or before performing another series of tests.

g. Always use the coated tip forceps when handling the combination filters; Dragendorff papers; or other test papers to prevent accidental con-

FROM: _____
UNIT: _____
PLACE: _____
DATE: _____ TIME: _____
TYPE SAMPLE & NO. _____

TESTS	RESULTS	TESTS	RESULTS
Anti-ChE		Gen. Gr.I	
G		PD	
CK		DC	
H		DM	
CX		Gen.Gr.II	
L&ED		Q&T	
L		Metals	
CG		Cd	
CN&BBC		W	
AC		SeO_2	
PS		HSR	
CN^-		P	
F^-		$PO_4^{\equiv}$	
Amine		NO_2/pH	/

CRAYONS	GA	H	CK	AC	L&ED

DRAG. PAPER:	TICKETS:

APPEARANCE: _____
SMELL: _____
EFFECT ON MEN: _____
_____
_____
COMMENTS: _____
_____
_____
_____
_____
_____
_____

Figure 3-1 (U). Sheet from field notebook pad (U).

tamination from contact with rubber gloves, impregnated cotton gloves or the bare hand. Oil, grease, decontamination materials, impregnite, etc., on the hands may give false positive tests.

h. Use a white background to observe color changes in daylight and the viewing box of the ultraviolet lamp to observe color changes at night.

i. In cold weather (below 32° F.) warm samples and reagents to approximately body temperature before performing tests. Warm reagent bottles in the palm of the hand (inside the glove) until the reagent thaws. Warm the sample in the waterbath.

j. Use the waterbath for warming (temperatures below boiling). Use the flame of the burner for heating above boiling.

3-2. Sensitivity of Tests

a. When two or more different tests are performed for the identification of an agent, one test may show a positive test and the other a negative test.

This discrepancy is not necessarily a result of an error on the part of the operator; it may be due to a low concentration of agent and the difference in the sensitivity of the various tests. A table indicating the sensitivity of the various tests for GA is given below as an example. It is obvious that at a concentration of 1 mmg/l, TESTS 1, 3, and 12 would be positive but TEST 5 negative. As a result the operator may hesitate to identify the compound as GA. Table IV gives a complete summary of the sensitivities of the various tests.

TABLE I (U). Sensitivity of Tests for GA (U)

Test name	Test number	Sensitivity (mmg/l)
Anti-ChE	1	0.03
Schoenemann	3	0.8
Dragendorff	5	30.0
(CN^-)	12	0.5

b. The use of too much reagent will decrease the sensitivity of a test and smear the test color. Too little reagent may not produce a color change. Unless a specific amount of reagent is given in the test procedures, use only enough reagent (1 to 3 drops) to moisten the gel or test paper.

3–3. Unknown Agents

a. Although the sampling and analyzing procedures have been designed for known CW-agents, information covered in the discussion of the tests is given in sufficient detail to enable a skilled chemist to evaluate the results of the tests and attempt to identify unknown CW-agents or to modify a test to identify an unknown agent. Because it is difficult to predict what conditions may be encountered in a particular situation, much must be left to the ingenuity, skill, and training of the operator in the application of these instructions and interpretation of the test results. Once the operator has become proficient in the use of the kit and thoroughly understands the chemistry of the tests, he may modify the procedures to meet the situation.

b. If the presence of an agent is suspected and no positive test results are obtained or if unexplained test colors are observed with the vapor tests, seal the ends of three exposed single white band detector tubes with detector tube end-seals. Place the sealed tubes and a completed test report in a shipping envelope and send them to a base laboratory.

Section II. (U) PREPARING REAGENTS

3–4. General

a. Each reagent set contains extra containers of those reagents that are used most frequently and those that deteriorate more rapidly than the others. Some reagents are ready for use; others require further preparation. Fill empty reagent bottles as needed.

b. Heat, direct sunlight, and exposure to air will hasten the deterioration of many reagents. Keep reagents away from heat and direct sunlight as much as possible. Tightly cap reagent bottles after each use.

c. Once a set of reagents has been prepared for use and even though none of the reagents has been depleted, discard and replace the set after 6 months in the desert or in the tropics, 12 months in temperate climate, and 18 months in the Arctic.

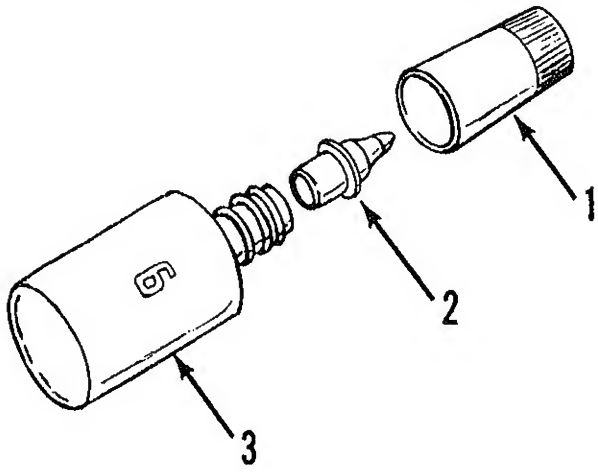
3–5. Preparing Reagents

Do not prepare reagents until just before they are to be used. Mark the date on the side of each bottle, and mark the top of each bottle with the letter "X".

a. REAGENTS 4, 5, 13, and 28 are packaged ready for use (REAGENT 4 is packaged separately from the reagent set).

b. Prepare REAGENTS 7 through 12, 15 through 26, 29, and 30 as described below:

(1) Loosen cap (1) on squeeze bottle (3), to relieve internal pressure.
(2) Compress walls of bottle slightly by squeezing, and at the same time retighten the cap.
(3) Squeeze bottle to crush all ampoules.
(4) Shake vigorously for 15 to 30 seconds.
(5) Remove cap, invert bottle, and release 4 or 5 drops of solution from the tip (2).
(6) Recap bottle tightly.



1 Cap 2 Tip 3 Bottle

Figure 3–2 (U). Squeeze bottle (U).

c. Prepare REAGENT 3 each day the kit is in use. Discard leftover solution at the end of the day (24 hours), and wash the bottle thoroughly. To prepare REAGENT 3:

(1) Remove the cap, then remove the tip from the squeeze bottle (fig. 3–3).
(2) Place 1 tablet of REAGENT 1 and contents of 1 packet of REAGENT 2 in the bottle.

(3) Crush the tablet by squeezing the walls of bottle.
(4) Fill the bottle to the shoulder with clear, clean water.
(5) Replace the tip and screw the cap on tightly.
(6) Shake the bottle vigorously until little or no solid settles to the bottom.

d. Prepare REAGENT 6 as needed:
(1) Remove the cap and tip from the squeeze bottle.
(2) Fill the bottle half full with alcohol from the red marked tube.
(3) Replace the tip and screw the cap on tightly.

e. Prepare REAGENT 27 as needed:
(1) Remove cap (1) and tip (2) from the squeeze bottle (3).
(2) Fill the bottle to the shoulder with clear, clean water.
(3) Replace the tip and screw the cap on tightly.

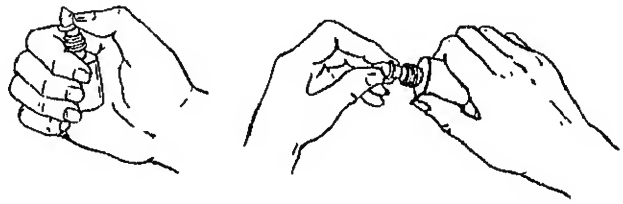


Figure 3–3 (U). Removing the tip from the squeeze bottle (U).

3–6. Checking Reagents

If there is an interval of more than one or two days between each use, check the date of preparation and inspect the reagents for signs of deterioration as given below:

a. REAGENT 1 is good for 3 years. Discard all broken tablets.

b. REAGENT 2 is good for 3 years. Discard all opened or broken packets.

c. REAGENT 3 is prepared fresh each day that the kit is in use.

d. REAGENT 4 is good indefinitely. The solution must be red or orange. If the solution is blue, discard.

e. REAGENT 5 is a colorless solution which is good indefinitely.

f. REAGENT 6 is filled with alcohol as needed.

g. REAGENT 7 is a yellow solution. Disregard any white precipitate that forms on bottom of bottle.

h. REAGENT 8 is good indefinitely.

i. REAGENT 9 is good indefinitely.

j. REAGENT 10 is good for only 1 day.

k. REAGENT 11 is good for only 1 day.

l. REAGENT 12 is good indefinitely.

m. REAGENT 13 should match the neutral green color of TEST 47 as shown on the direction cards. If the solution is yellow, add drop of REAGENT 8, or if blue, 1 drop of REAGENT 25 to return it to the neutral color. The solution is good indefinitely.

n. REAGENT 14 is good for 2 or 3 days. To determine when the prepared reagent should be discarded, perform the following test: Place drop of RE-

AGENT 14 on a piece of paper from the paper dispenser (handle paper with coated tip forceps) and allow it to evaporate. If the reagent leaves a pink, purple, or yellow spot, discard.

o. REAGENT 15 is good for 2 days.

p. REAGENT 16 is good indefinitely.

q. REAGENT 17 is usable until solution becomes dark brown.

r. REAGENT 18 is good for 3 days.

s. REAGENT 19 is good as long as there is a strong odor of ammonia.

t. REAGENT 20 is good for 4 days.

u. REAGENT 21 is good for 4 days.

v. REAGENT 22 is good for 1 to 2 days. To determine when the prepared reagent should be discarded, perform the following test: place a drop of reagent on a piece of paper from dispenser (handle paper with the forceps) and allow the solvent to evaporate. Compare color of spot on the paper with color of negative TEST 23, as shown on the direction cards. If color is other than that of the negative test, discard.

w. REAGENT 23 is good for 7 days.

x. REAGENT 24 is good for 6 days.

y. REAGENT 25 is good indefinitely.

z. REAGENT 26 is good for 3 days.

aa. REAGENT 27 is good indefinitely.

bb. REAGENT 28 is good for 3 years when packets are unopened. Discard all opened or broken packets.

cc. REAGENT 29 is good as long as the color does not change to brown or red-brown. If color is very light blue, the reagent is good.

dd. REAGENT 30 is good as long as the color of the reagent remains the same as the negative TEST 14 as shown on the direction cards.

Section III. (C) VAPOR TESTS

3-7. (U) General

a. Optimum vapor test results are obtained when the humidity is low. When the humidity is high many of the interstices of the silica gel are filled by molecules of water, leaving fewer sites for absorbing agent vapors. High humidity adversely affects the sensitivity of tests for those agents which are hydrolyzed by water.

b. Some CW-agents will rapidly desorb from the silica gel in the detector tube. The direct color tests start fading within 15 to 30 minutes after the sample has been collected in the tube. Therefore, observe the color tests in the detector tubes listed below as soon as possible after collecting the sample.

Test	*Detector tube*
TEST 2 (CK)	Single blue band
TEST 7 (L, ED, MD)	Single yellow band
TEST 9 (CG)	Single green band
TEST 10 (AC)	Single red band

c. Persistent agents in detector tubes produce distinct color bands when tested. The width of the band may vary depending on the concentration of the agent. If volatile solvents are associated with the persistent agent, the

color band may smear throughout the gel. Nonpersistent agents usually produce a coloration spread through the silica gel, however, they may produce color bands if the concentrations are extremely low.

d. Add reagents dropwise to the color coded end of a detector tube by gently squeezing the sides of the bottle between thumb and forefinger (fig. 3–4). To prevent accidental contamination of the reagent, remove the tip from the detector tube before releasing the pressure on the side of the bottle.

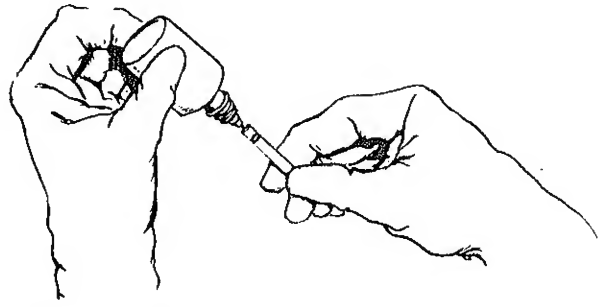


Figure 3–4 (U). Adding reagent to detector tube (U).

e. Some CW-agents may undergo chemical change or desorb from silica gel tubes by the time that they are tested. Test results indicate CW-agents present at the time of testing, but not necessarily those present at the time of sampling. For example, phosgene oxime (CX) decomposes rapidly to form cyanide and phosgene. Tests may be negative for phosgene oxime but positive for cyanide and phosgene.

f. Mixtures of toxic vapors consisting of both persistent and nonpersistent agent adsorbed on unimpregnated silica gel (WHITE BAND TUBE) can sometimes be handled in a manner similar to the following example of a mixture of CK and HD in a BLUE BAND TUBE. If a BLUE BAND TUBE indicates a positive test for CK but the presence of a persistent agent (HD) is suspected:

(1) Transfer silica gel from an exposed WHITE BAND TUBE to test a tube (fig. 3–5).
(2) Warm the test tube for 1 to 2 minutes to desorb nonpersistent agent (CK).
(3) Add 2 drops of REAGENT 18 and heat for an additional 2 minutes.
(4) If no color develops, omit (5) through (7) below.
(5) If yellow or orange color develops, CK is still present (see TEST 2).
(6) Using another exposed WHITE BAND TUBE, perform steps (1), (2), and (3) again but heat tube 3 to 5 minutes.
(7) If test is still yellow or orange, separation cannot be performed.
(8) If no color develops, add 1 drop of REAGENT 12 and observe color change. See TEST 4 for interpretation of color change.

g. The presence of nontoxic smoke such as FS, and to a lesser extent, FM and P_2O_5 will interfere with almost all CW-agent tests.

h. When the ambient temperature is below 45° F., warm the agent detector tubes for a few seconds.

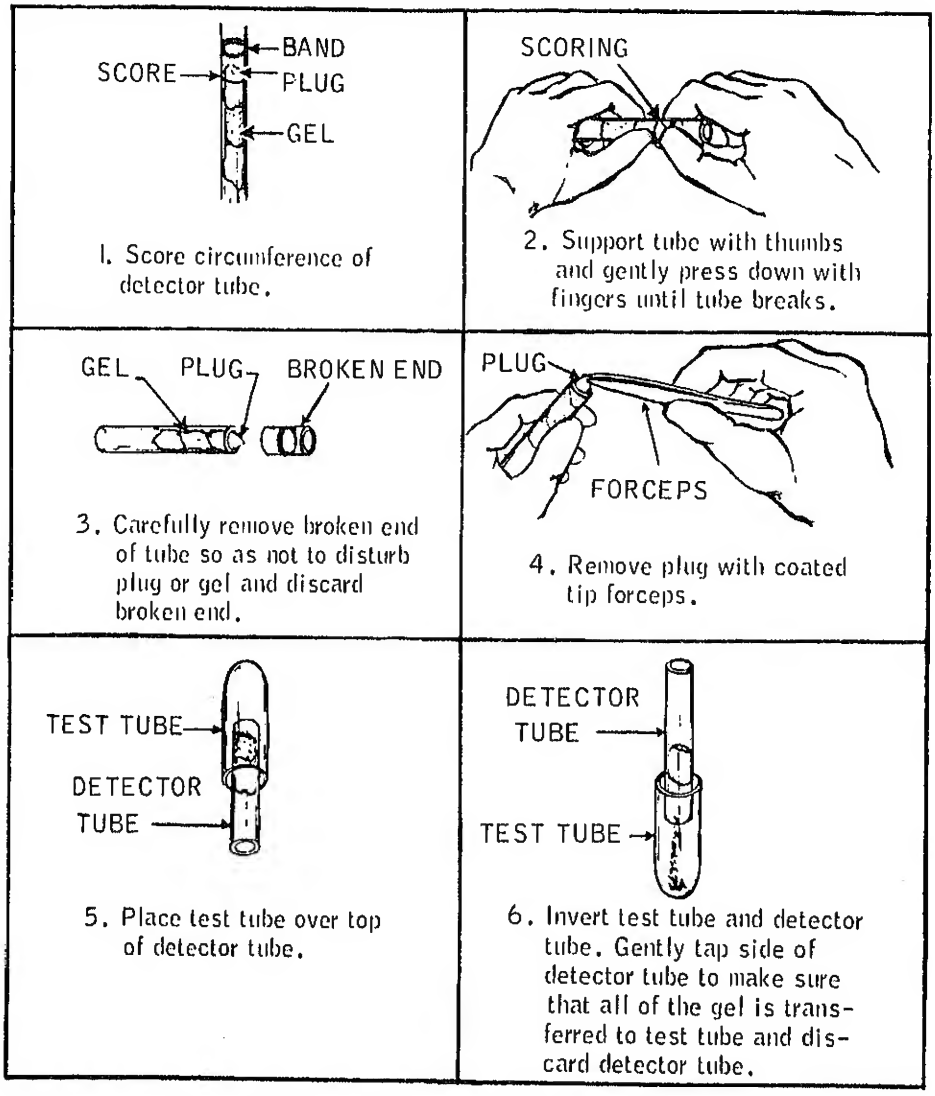


Figure 3-5 (U). Transferring silica gel from detector tube to test tube (U).

3-8. (C) Vapor Tests (TESTS 1 through 16)

Vapor tests are given below in numerical sequence (TEST 1 through TEST 16).

(U) TEST 1 (Anti-ChE)

General Test for anticholinesterase (Anti-ChE) material (phosphoro, phosphono, quaternary ammonium salts, and carbamates).

Specific Test for G- and V-type agents.

a. Procedure. See paragraph 2-4 and figure 2-2.

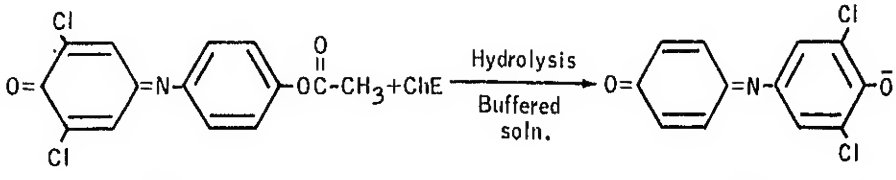
b. Interpretation. See figure 2-2.

(1) Presence of Anti-ChE material—(no blue coloration). If Anti-ChE material is present, perform TESTS 3, 6, 12, 13, 14, and 15 to identify the specific Anti-ChE.

(2) Absence of Anti-ChE material—(blue coloration). If Anti-ChE material is absent, omit TESTS 3, 6, 12, 13, 14, and 15.

c. Chemical Reaction

(1) No agent present



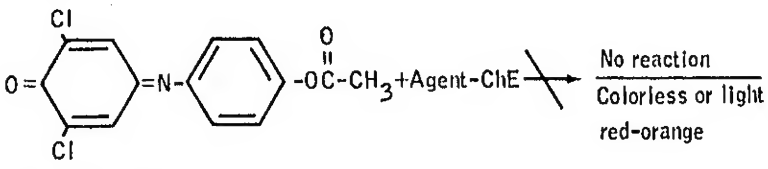
Red
2,6 Dichloroindophenyl acetate

Blue
2,6 Dichloroindophenylate

(2) Agent present

(a) Agent + ChE ⟶ Agent - ChE

(b)



d. Discussion.

(1) In the presence of Anti-ChE material, the appearance of a light-blue color after 5 minutes may be disregarded. The blue coloration may be due to a situation where the concentration of the Anti-ChE material is near the minimum detectable concentration of this test.

(2) The absorption of strong acid vapor or aerosols (for example, L, F, S, NO_2, P_2O_5 from WP) may give false indication of the presence of Anti-ChE material. Strong acids prevent the formation of the blue indophenolate ion. Likewise, a strong base will hydrolyze the 2, 6-dichloroindophenyl acetate to form the blue color.

(U) TEST 2 (CK)

General Test for highly reactive alkylating and acylating agents (carbonium ion formation).

Specific Test for Cyanogen chloride (CK).

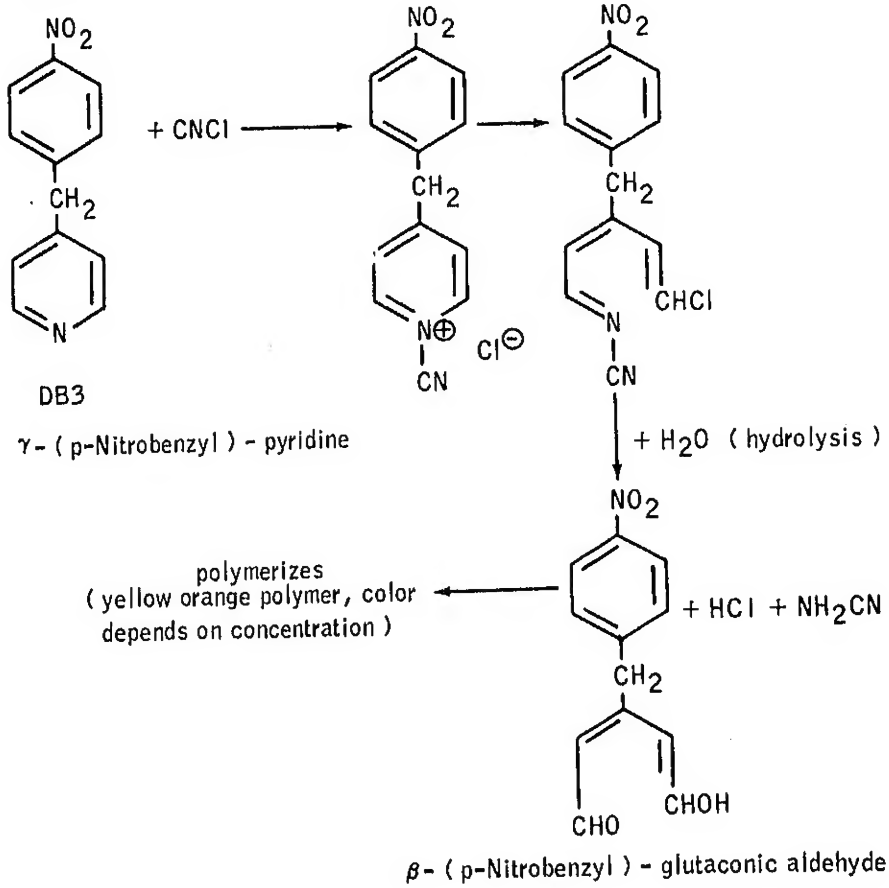
a. Procedure. Direct color test on BLUE BAND TUBE.

b. Interpretation.

(1) Positive test. Light yellow, yellow-orange, or dark-orange color. (If color change is doubtful, compare against unexposed detector tube.)

(2) Negative test. No color change.

c. Chemical Reaction.



d. Discussion.

(1) When a weak or doubtful color test is observed compare the color with that of an unexposed BLUE BAND TUBE because the DB3 impregnated gel may have become yellow upon aging.

(2) The yellow to orange color of this test is also given by cyanogen bromide, xylyl bromide, and BBC. (See TEST 4 for a detailed discussion.)

(U) TEST 3 (Schoenemann Reaction)

(Perform this test only if TEST 1 is positive and TEST 2 is negative.)
General Test for compounds that form perphosphonate ions and peracids, and strong oxidizing agents.
Specific Test for G-type agents (GA, GB, etc.).

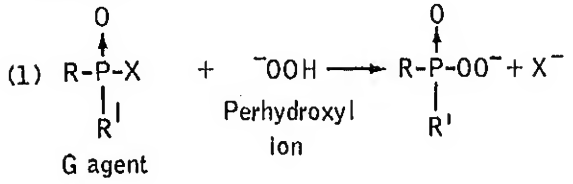
a. Procedure. Add REAGENT 3 to BLUE BAND TUBE and observe color change. (Use a WHITE BAND TUBE if a BLUE BAND TUBE is not available.)

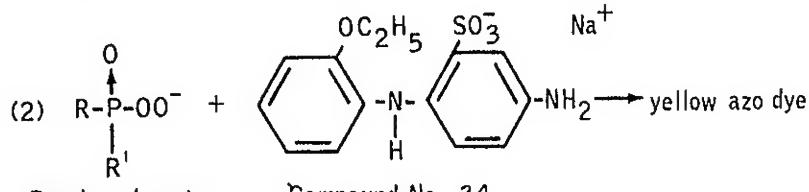
b. Interpretation.

(1) Positive test. Light to deep yellow color. Perform TESTS 6, 12, 13, 14 and 15 to identify the specific G-Agent.

(2) Negative test. No color change or any color other than yellow. Blue, green-blue or purple colors indicate presence of strong oxidizing agents.

c. Chemical Reaction





d. Discussion.

(1) This test is based on the oxidation of an amine. Strong oxidizing agents, such as Cl_2, Br_2, and NO_2 will interfere with the test. Most strong oxidizing agents will give blue, purple, and blue-green colors rather than the yellow color observed with G-Agents. Chlorine vapors will give a yellow-brown color. Many organophosphorus insecticides and compounds such as tetraethylpyrophosphate and hexaethyltetraphosphate will give the yellow positive test.

(2) Because the Schoenemann reaction as performed here will not detect V-Agents, it serves as a method of distinguishing between V- and G-type agents. More generally, it distinguishes between G-Agent and other types of Anti-ChE materials detected in TEST 1.

(3) REAGENT 3 must be prepared fresh each day the kit is in use because, on standing, the peroxide (REAGENT 2) oxidizes the amine (REAGENT 1) to a purple and then to a yellow dye. The presence of a heavy metal salt such as (Fe^{+++}), some solvents such as acetone and alcohol, sunlight, or heat catalyze the oxidation of the amine.

(U) TEST 4 (DB3-NaOH)

(Perform only if TEST 2 is negative.)
General Test for alkylating and acylating agents.
Specific Test for sulfur mustard (HD), Nitrogen mustards (HN) and Phosgene oxime (CX).

a. Procedure. Wait 2 minutes after sampling before performing this test Add REAGENT 12 to BLUE BAND TUBE and observe color change.

b. Interpretation.

(1) Positive test. The following color changes indicate positive tests for mustards or phosgene oxime:

Color	*Agent*
Narrow blue band	HD, HN (low concentrations)
Broad purple-blue band	HD, HN (high concentrations)
Red-brown	CX
Red-purple	Mixture of agents (e.g. HD and CX)

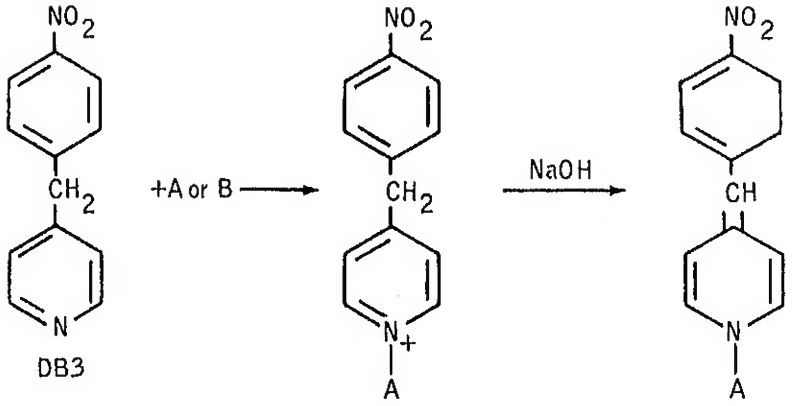
(2) Negative test. No color change or any color change other than (1) above indicates absence of mustard and phosgene. See d below.

c. Chemical Reaction. The following chemical reactions are for HD and HN. This reaction mechanism also applies to Q, T, CN, and H-sulfone.

(1) (a) $ClCH_2CH_2\text{-}S\text{-}CH_2CH_2Cl$ (HD) $\longrightarrow$ $\left[ClCH_2CH_2\text{-}S\text{-}CH(CH_2)\right]^+ + Cl^-$ (A)

(b) $ClCH_2CH_2\text{-}N(CH_2CH_3)\text{-}CH_2CH_2Cl$ (HN) $\longrightarrow$ $\left[ClCH_2CH_2\text{-}N(CH_2CH_3)\text{-}CH_2\text{-}CH_2\right]^+ + Cl^-$ (B)

(2)



a (p-Nitrobenzyl)-Pyridine — Colorless — Purple-blue

NOTE: Mercuric cyanide is incorporated as a catalyst.

d. Discussion.

(1) In the presence of a base DB3 reacts slowly with alkylating agents; more slowly with acylating agents, and very slowly with phosphorylating agents to give a dye. (DB3 reacts with methyl iodide, dimethyl sulfate, and benzylchloride. It does not react with chloroform, carbon tetrachloride, or acetylene tetrachloride.)

DB3 will react directly (without addition of base) with CK, cyanogen bromide, xylyl bromide and with very high concentrations of BBC to give a yellow to orange dye. The addition of caustic darkens the color to red or black.

(2) To develop the color test, a 2-minute incubation period is required to permit the alkylation reaction (para c(2)) to take place before adding the base to the gel. The mercuric cyanide which is impregnated on the gel is used as a catalyst in the alkylation step of the reaction. At near-freezing temperatures, the sample may require warming. The tube may either be placed inside the glove and held in the palm of the hand for 2 minutes or warmed at 100° C. for 30 to 60 seconds.

(3) Many CW-agents will give color tests with DB3 plus base, but the reaction usually requires heating (100°–200° C.) or extremely high concentrations of agent to obtain a positive test.

(4) Some of the reaction products of mustard also give color reactions with DB3. Chlorinated mustard (from areas decontaminated by chlorine) and chlorinating agents produce dyes whose colors vary from red to brown to red-blue, but because of the low vapor pressure of these products, large quantities of contaminated air are required. The hydrolysis products of mustards which have been decontaminated by water, steam, or caustic solution do not give color reaction with DB3. Mustard sulfoxide, the reaction product of mustard and nitric acid, does not give a positive test with DB3, but the sulfone (H-sulfone) does, if a very high concentration of the vapor is collected on the tube. High concentrations of mustard polysulfide, the chief constituent of the nonvolatile residue of Levinstein mustard (H), gives a positive DB3 test.

(5) Chlorinated solvents, such as acetylene tetrachloride (often used in decontamination), do not react, but high concentration of the vapors affect the appearance of the test. The normal purple-blue band associated with the mustard test will appear less intense.

(6) Strong acids or acidic CW-agents (AC or L) in the presence of mustards appreciably reduce the sensitivity of the test. The effect of acid on the DB3 gel may be overcome by drawing very small amounts of ammonia vapor (REAGENT 19) through the detector tube. (Addition of too strong a caustic solution to the gel will cause a slight browning which may be overcome by diluting the caustic solution.)

(7) If REAGENT 19 (NH_4OH) is used in place of REAGENT 12 (NaOH) for CN, Q, T, and H-sulfone, the test color is purple-blue. The detector tube test for H-sulfone, Q, and T require very high concentrations of agent; H-sulfone, Q, and T are more likely encountered as particulate matter in the smoke sample (TEST 20). CG gives an initial color test similar to CX but fades within 2 minutes. The red-purple color for CG is persistent if base plus REAGENT 24 (sulfite) is used (TEST 5).

(8) A partial listing of color reactions with various CW-agents follows: The colors listed below will vary depending on the concentration.

Colors appear on addition of REAGENT 12 except as noted in direct tests.

Color	*Agent*
Purple-blue	HD
Purple-blue	HN
Light brown band*, red-brown	CX
Blue	H-sulfone
Blue	Q
Blue	T
Yellow to orange*, red to black	CK
Brown*, blue	CN
Yellow to orange*	BBC
Brown*, red-purple (REAGENT 24)	PS
Red-brown	CG
Green black**	ED
Blue	Ethyl bromoacetate
Purple-blue	Dimethyl sulfate
Red-violet*	Benzyl chloride
Yellow to orange*, blue	Xylyl bromide
Yellow to orange*, red to black	Cyanogen bromide
Brown	Sulfur chloride
Blue	HD polysulfide
Yellow to orange*	Arsine (SA)

*Direct Test
**Very high concentration is required

(U) TEST 5 ($DB3\text{-}SO_3$)

(Perform only if TEST 2 and TEST 4 are negative.)
General Test for alkylating and acylating agents (see TEST 4).
Specific Test for chloropicrin (PS).

a. Procedure. Add REAGENT 24 to BLUE BAND TUBE and observe color change.

b. Interpretation.

(1) Positive test. Red-purple color.

(2) Negative test. No color change or any color change other than red-purple is a negative test. (See Discussion in TEST 4.)

c. Reaction. The mechanism of this reaction is unknown but is believed that the sodium sulfite reacts with chloropicrin (PS) to form a more reactive alkylating agent which in turn attacks the pyridine ring of DB3 to form the red dye in the CK reaction (TEST 2).

d. Discussion. PS is not readily retained on the silica gel in the tube; the agent may desorb within 1–2 hours. The discussion of TEST 4 also applies to this test. The interferences listed in TEST 4 are the same but with the following modification in colors.

Color	*Agent*
Orange to red (persistent)	CG, triphosgene, and diphosgene
Gel speckled with black spots	ED
Orange	CN
Purple (deeper than that in TEST 4)	CK
Purple	Cl_2

(C) TEST 6 (Dragendorff) (U)

General Test for tertiary amines, quaternary ammonium salts, alkaloids and thioamides, some secondary amines, heavy metal salts, and arsenicals.

Specific Test for V-agents (containing tertiary amines), GA and nitrogen mustards (HN).

a. Procedure. Add REAGENT 7 to WHITE BAND TUBE and observe color change within 1 minute.

b. Interpretation. See table II below.

(1) Positive test. Red-orange or orange color.

(2) Negative test. Yellow or the absence of a red-orange band is a negative test.

Table II (C). Evaluation of Modified Dragendorff Test Results (U)

TEST 1 (Anti-ChE)	TEST 4 (DB3-NaOH)	TEST 6 (Dragendorff)	Agent(s) present
Absent	Positive	Negative	Sulfur mustard.
Absent	Positive	Positive	Nitrogen mustards (HN-type).
Present	Negative	Positive	V-agent or GA (TEST 3 confirms V-agent or GA).
Absent	Negative	Positive	Tertiary amines quaternary ammonium salts, etc.

c. Chemical Reaction. Basically the chemical reaction is as follows:

$$HBiI_4 + NR_3 \longrightarrow HBiI_4 \cdot NR_3$$

Yellow — Complex double salt red-orange

d. Discussion.

(1) This test is a general test for most alkaloids and substituted amines. The greater the basicity and the more highly substituted the amine, the more sensitive is the test. The Dragendorff reagent will not detect primary amines. It will detect highly branched secondary alkyl amines, most heterocyclic secondary amines, nearly all tertiary amines and quaternary ammonium salts with the exception of a tertiary nitrogen common to more than one ring. In addition, it will detect high concentrations of NH_3, tobacco smoke, thioamides ($-\overset{\overset{S}{\|}}{C}-NH_2$) but not amides ($-\overset{\overset{O}{\|}}{C}-NH_2$), and most arsenicals. It will form colored doubled salts with many of the heavy metals. The color change is usually from yellow to red-orange. Some extremely basic tertiary amines may form a white precipitate due to hydrohalide salt formation.

(2) The test color must be viewed within 2 minutes after addition of REAGENT 7, because HD (if present) will slowly develop a positive test color.

(3) REAGENT 7 may also be used directly on suspected contaminated surfaces or for preparing test papers. The test papers are stable for a few hours but will require the addition of water to develop the test color if the solvent has evaporated.

(U) TEST 7 (Molybdenum Blue)

General Test for strong reducing agents and volatile arsenicals.

Specific Test for Lewisite (L), Ethyldichloroarsine (ED) and Methyldichloroarsine (MD).

a. Procedure.

(1) Observe SINGLE YELLOW BAND TUBE for color change. If there is a marked blue-green or yellow-green color, omit next step.

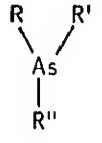
(2) If there is no color change or a very slight color change, add REAGENT 12 and observe color change.

b. Interpretation.

(1) Positive test. A direct blue-green color indicates presence of ED or MD. A yellow-green color indicates very high concentration of L. If a blue or blue-green color is produced, after REAGENT 12 is added, the presence of ED, L, MD, or a mixture is indicated. (See paragraph d below.) Presence of L is confirmed by TEST 8.

(2) Negative test. No color change indicates the absence of ED, MD, and possibly L.

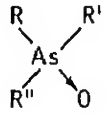
c. Chemical Reaction. Arsenicals such as L, ED, and MD are compounds of trivalent arsenic and may be represented by the following general formula:



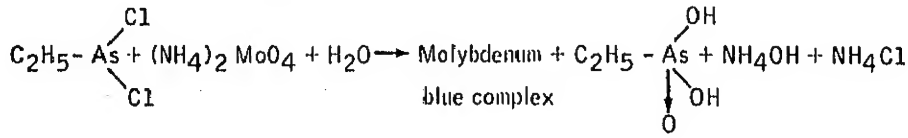
Where:

R = Cl
R' = Cl
R" = C_2H_5, CH_3, C_2H_2Cl

They can be oxidized to the pentevalent arsenic of the following general formula:



Trivalent arsenicals reduce ammonium molybdate to molybdenum blue. The exact constitution is unknown.



d. Discussion.

(1) This test has poor sensitivity to L and the sensitivity is further reduced if the humidity is high. The sensitivity of the test may be increased by heating the detector tube to 100° C. prior to the addition of reagent.

(2) If a high concentration of the vapors of the aromatic-type arsenicals, such as PD, DA, DM, and DC, penetrate the combination filter and enter the detector tube, a positive test will be obtained.

(3) This test depends on the reducing properties of the arsenical agents. Reducing agents, such as SO_2, arsine, and H_2S in high concentration,

and acid vapors such as HCl in low concentration will, if present, interfere with the test.

(U) TEST 8 (Acetylide)

General test. For compounds which liberate acetylene on addition of base.
Specific test. For Lewisite (L) and L-oxide.

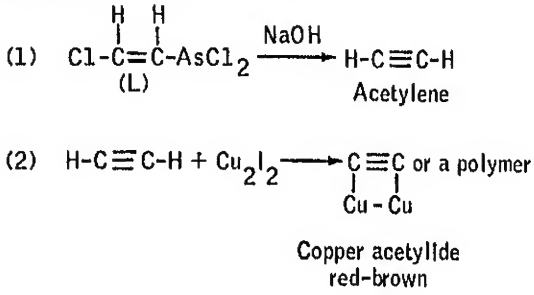
a. Procedure. Add REAGENT 12 to DOUBLE YELLOW BAND TUBE and observe color change.

b. Interpretation.

(1) Positive test: Red-brown color.

(2) Negative test: If there is no color change or if the color is other than red-brown, the test is negative. See discussion.

c. Chemical Reaction



d. Discussion.

(1) Lewisite is readily decomposed by water or moisture to form Lewisite oxide, which is a solid having a very low vapor pressure. TEST 7 may not give a positive test for L vapors even though the area originally may have been heavily contaminated.

(2) The red-brown color in this test is very specific for L and L-oxide as the color is the result of the reaction of acetylene with cuprous ions.

(3) Large quantities of alkali cyanide will prevent the formation of cuprous acetylide (red-brown color) due to the formation of the colorless cuprous cyanide complex $[Cu_2(CN)_4]^{-2}$. Ammonia vapor, NH_3, will produce a blue color due to the formation of a blue copper ammonium complex. Sulfides will produce black cuprous sulfide. Some mercaptans will produce a yellow cuprous salt. CX may produce a yellow color without addition of reagent.

(U) TEST 9 (PDB–PAN)

General test. For acyl halides.
Specific test. For phosgene (CG). CG is not retained on the gel for more than 1 hour.

a. Procedure. Observe color change in SINGLE GREEN BAND TUBE.

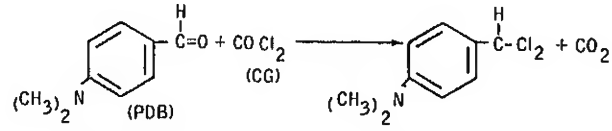
b. Interpretation.

(1) Positive test. Light-green to green-black color. (The green color will vary depending on the concentration of the CG.)

(2) Negative test. If the color of the gel is unchanged or if the color is other than green, the test is negative for CG. (See discussion.)

c. Chemical Reaction.

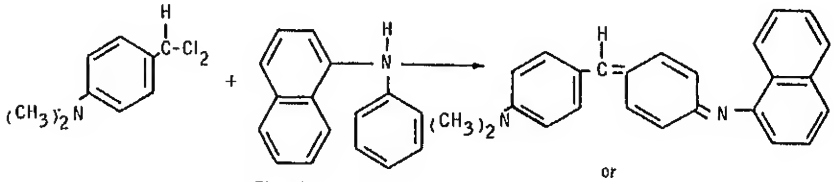
(1)



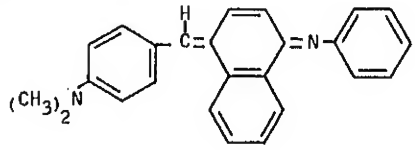
p-Dimethylamino-benzaldehyde

p-Dichloromethyl-n,n dimethylaniline

(2)



Phenyl-α-napthylamine (Pan)



Green

d. Discussion.

(1) Very high concentrations of CK, diphosgene, and triphosgene give positive tests. In general any agent which will convert $-CHO$ to $-CHCl_2$ as above, PCl_5 and PCl_3, will give positive tests.

(2) Primary amines react with PDB to form highly colored Schiff bases in the presence of strong acid or acidic agents. High concentrations of strong acidic agents turn the gel yellow. Strong oxidizing CW-agents will produce color changes due to the oxidation of the amines.

(3) PS will produce a green-yellow color; chlorine, a green-yellow-brown color; and oxides of nitrogen, an orange-red color. Addition of base to the exposed detector tube will produce an orange-red color if CG is present.

(U) TEST 10 (Tetra-Base)

General test. For cyanide, cyanogen, and strong oxiding agents.

Specific test. For hydrogen cyanide (AC).

a. Procedure. Observe RED BAND TUBE for color change.

b. Interpretation.

(1) Positive test. Light to deep blue. (The intensity of color will vary with the concentration of AC.)

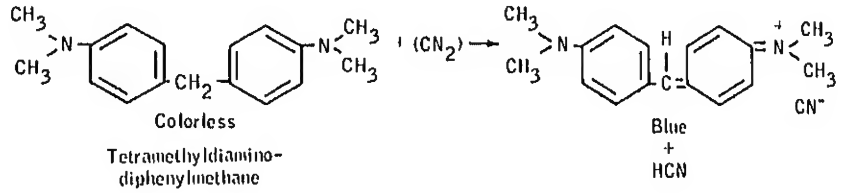
(2) Negative test. No color change or a color other than blue is a negative test for AC. (See discussion.)

c. Chemical Reaction.

(1) $Cu^{++} + 2HCN \longrightarrow Cu(CN)_2 + 2H^+$

$2Cu(CN)_2 \longrightarrow Cu_2(CN)_2 + (CN)_2$ (cyanogen)

(2)



d. Discussion.

(1) Free cyanide usually associated with GA, and decomposing DC and CK; strong oxidizing agents; and NH_3 will give positive tests.

(2) Sulfide ions give brown colors, and strong acid or acid agents (CX, ED) give a yellow color.

(U) TEST 11 (DNB)

General test. For carbanion.

Specific test. For chloroacetophenone (CN) and Bromobenzyl cyanide (BBC).

a. Procedure. Add REAGENT 12 to DOUBLE GREEN BAND TUBE and observe color change.

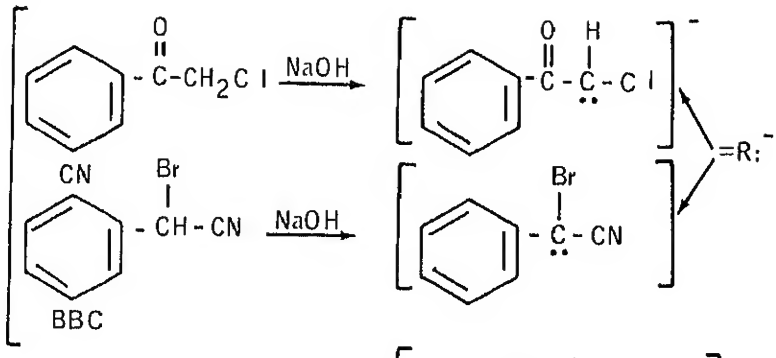
b. Interpretation.

(1) Positive test. Pink, red, or red-purple color (depending on the concentration of the agent) indicates the presence of CN, BBC, or a mixture of both agents.

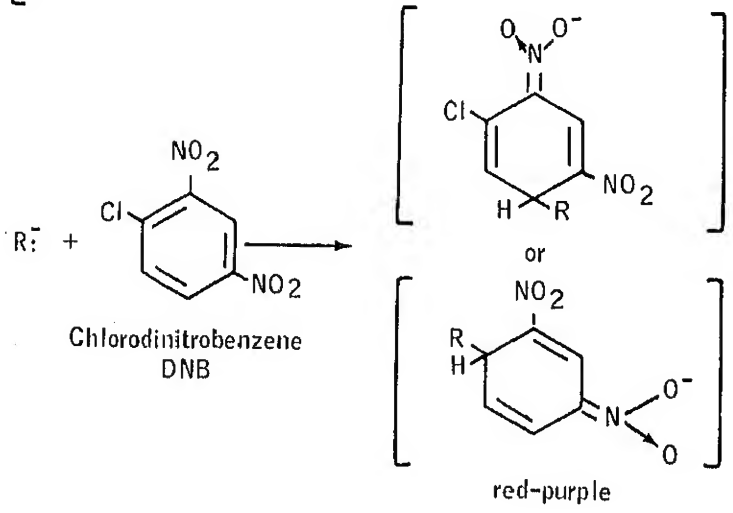
(2) Negative test. No color change or any color change other than pink, red, or red-purple indicates the absence of CN or BBC. (See discussion.)

c. Chemical Reaction.

(1)



(2)



d. Discussion.

(1) Compounds with active methylene groups or substituted methyl groups give positive tests. Phenyl acetaldehyde and benzonitrile give no positive tests, but acetone and benzyl cyanide do give positive tests. Ethyl acetate and ethyl malonate produce a green color, and some amines produce a yellow color.

(2) The condensation reaction which produces the red, pink, or red-purple color is associated with the CN and BBC test and the reduction reaction which produces a deep blue or black color are associated with some arsenicals, such as ED and MD.

(U) TEST 12 (Pyrazolone)

Perform this test if TESTS 1 and 3 indicate the presence of Anti-ChE agent and TEST 2 is negative.

General test. For hydrolyzable cyanide (CN^-), such as GA, DC, AC, CK.

Specific test. For GA.

a. Procedure.

(1) Transfer silica gel from WHITE BAND TUBE to a test tube (fig. 3-5).

(2) Add 1 drop of REAGENT 10 and 1 drop of REAGENT 11.

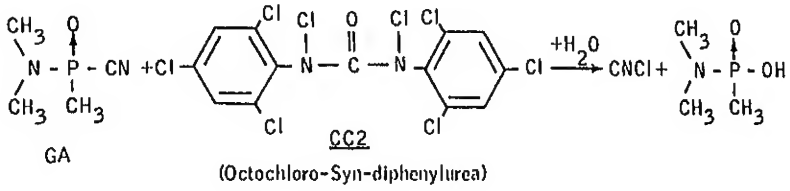
b. Interpretation.

(1) Positive test. Red-purple color indicates the presence of a GA-type agent in the sample. (See discussion.)

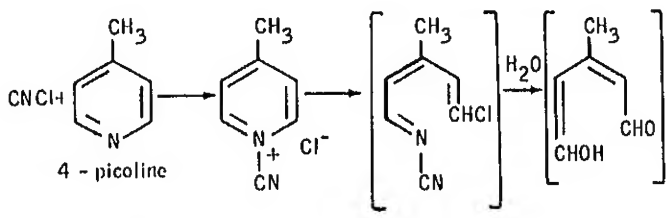
(2) Negative test. If there is no color change, the test is negative for CN^-. The G-agent in the sample is of a type other than GA. (See discussion.)

c. Chemical Reaction.

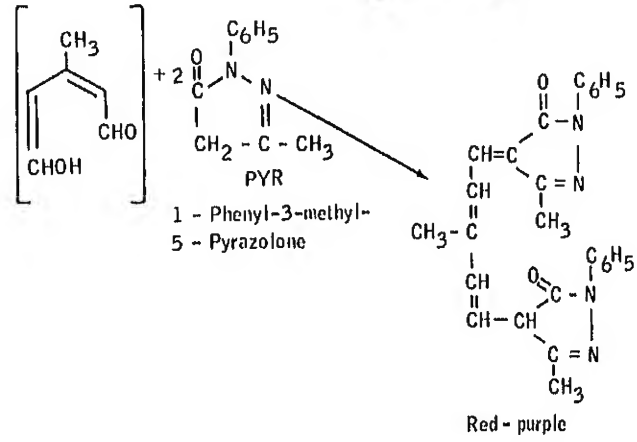
(1)



(2)



(3)



d. Discussion. Because this test is a general test for hydrolyzable cyanide, CK, AC, and DC will also give positive tests. Strong alkylating, acylating, and phosphorylating agents, will also produce color reactions if they attack the nitrogen of the pyridine ring to form a glutaconic aldehyde derivative. CX and PS do not produce color reactions. This test makes it possible to distinguish cyanide from halogen containing G-agents (GS from GB).

(U) TEST 13 (Alizarin Lake)

Perform this test if TEST 1 and TEST 3 indicate presence of Anti-ChE agent.
General test. For hydrolyzable fluoride (F^-) and phosphate.
Specific test. For GB-type agent (F^-).

a. Procedure. Run a blank test using an unexposed WHITE BAND TUBE. The procedure is the same for both the sample and blank. This test must be run concurrently with TEST 16.

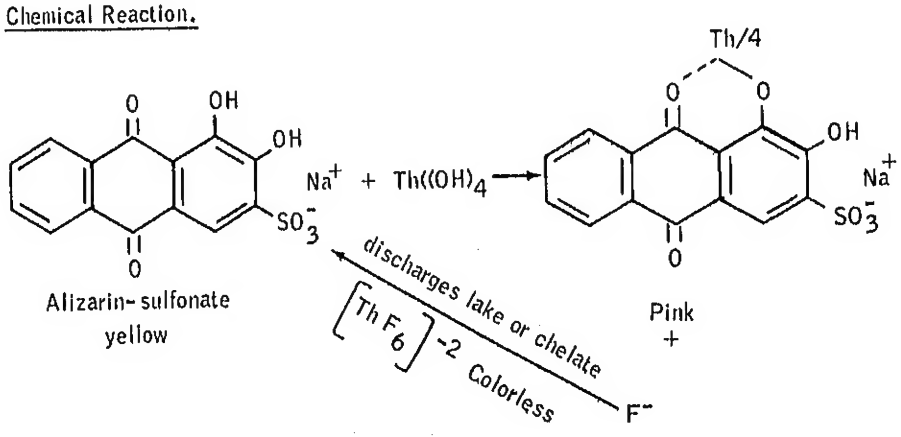
(1) Transfer gel from WHITE BAND TUBE to a test tube (fig. 3–5).
(2) Mark blank test tube with wax marking pencil.
(3) Add 3 drops of REAGENT 8 to blank and test sample and agitate.
(4) Stand tubes in rack for 1 minute.
(5) Add 3 drops of REAGENT 9 to each test tube and agitate.
(6) Color of blank must be pink. If it is not, add REAGENT 8 dropwise to blank, counting number of drops. Agitate test tube after each drop until color just changes to pink.
(7) Add equal number of drops of REAGENT 8 to sample test tube.
(8) Observe color change in sample test tube.

b. Interpretation.

(1) Positive test. The sample is yellow and the blank is pink (at low concentration the sample may be yellow-orange). The presence of fluoride ion (F^-) is indicated if TEST 16 is negative (see discussion). If both TEST 1 and TEST 3 indicate the presence of Anti-ChE agent, and this test is positive, the agent is of the —P—halogen and not —P—CN type.

(2) Negative test. If both the blank and the sample are pink, the test is negative.

c. Chemical Reaction.



Alizarin sulfonate is either absorbed on the surface of $Th(OH)_4$ to form a weak lake or a weak chelate as illustrated above. This lake or chelate is discharged when the Thorium ion forms a colorless complex with F ions.

d. Discussion.

(1) This test has a poor sensitivity (approx. 35 mmg/l) to detection of fluoride ion.

(2) It is important to have the blank and sample buffered at the same pH (acid side), therefore, care must be taken to add the same amount of base to the sample and blank.

(3) This test is a general test for hydrolyzable fluoride, such as HF, NaF, CaF, hydrolyzable organo fluorides, and silicon fluorides. Since phosphate, phosphonate, P_2O_5, and the like will also give a good positive test, the fluoride test must be confirmed by TEST 16. If TEST 16 is negative and this test is positive, fluoride ion is present. If both tests are positive, the presence of fluoride is uncertain.

(4) High concentrations of silicates, oxalates, sulfates, and other anions that readily form colorless complexes with thorium ion will also give positive tests. High concentrations of ED and L may interfere with the test.

(C) TEST 14 (Tetrazolium) (U)

Perform this test if TEST 1 indicates presence of agent and TEST 3 is negative.
General Test for mercaptans (^-SR), hydrolyzable thioesters, and strong reducing agents.
Specific Test for mercaptans for identification of V-type agents.

a. Procedure.

(1) Extract agent from WHITE BAND TUBE (fig. 3-6). Take care to prevent reagent from running down outside of detector tube.
(2) Discard detector tube after extraction.
(3) Place test tube in heating block and evaporate contents to dryness.
(4) Remove test tube (with test tube holder).
(5) Allow tube to cool (30–60 seconds).
(6) Add 2 drops of REAGENT 8 and wait 1 minute.
(7) Add 1 drop of REAGENT 30.
(8) If color of the material in the test tube is yellow, add 1 more drop of REAGENT 30.

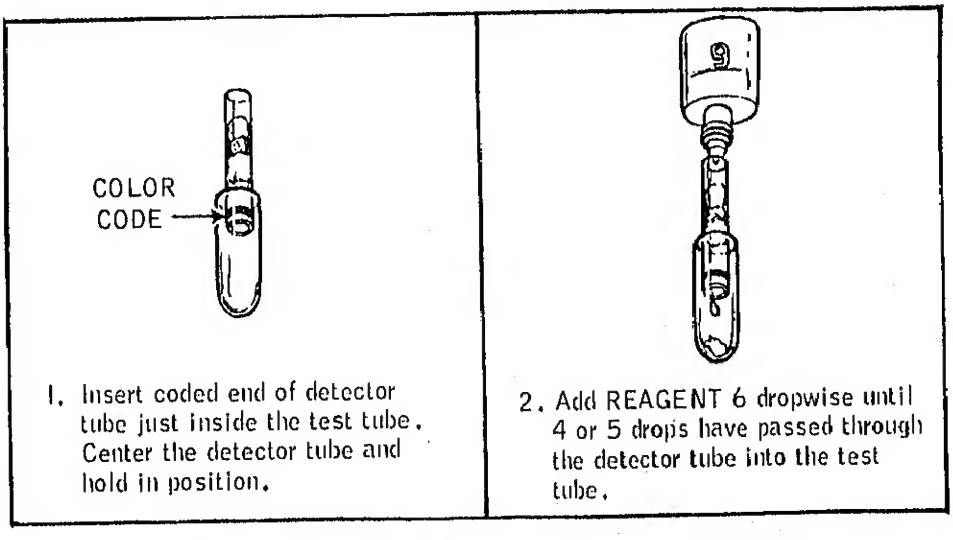


Figure 3-6 (U). Extracting agent from detector tube (U).

b. Interpretation.

(1) Positive Test. Red or purple-brown color.

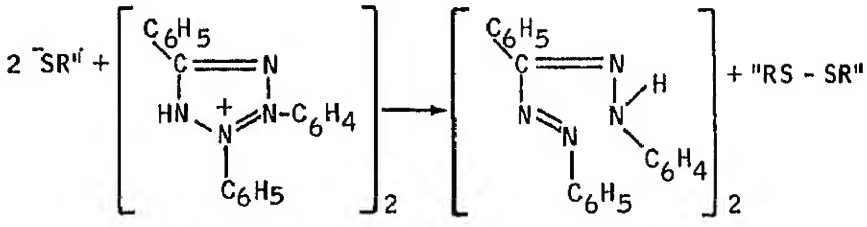
(2) Negative Test. A yellow or yellow-brown color.

c. Chemical Reaction.

(1)

V Agent

(2)



Neotetrazolium chloride

Tetrazolium red

d. Discussion.

(1) This test is a general test for mercaptans and hydrolyzable thioesters. Because of the oxidation-reduction reaction which takes place, a high concentration of strong reducing agents will inhibit the reaction.

(2) When performing this test to detect a volatile mercaptan, omit a (3) to (5) even though the presence of the solvent in the test tube may decrease the sensitivity of the test.

(C) TEST 15 (ODN-Molybdenum Peroxide) (U)

Perform this test if TEST 1 indicates presence of agent or for the general identification of organophosphorous compounds.

General Test for $(PO_4)^{\equiv}$ from organophosphorous compounds, silicates, and some heavy metals.

Specific Test for organophosphorous as phosphate ion $(PO_4)^{\equiv}$.

a. Procedure.

(1) Run a blank test with this test. Follow procedure (1) through (5) of TEST 14.

(2) Transfer contents of one packet of REAGENT 28 to test tube.

(3) Add 1 or 2 drops of REAGENT 6 to wash down any particles of REAGENT 28 adhering to wall of test tube.

(4) Evaporate solvent in heating block (1–2 minutes).

(5) Remove test tube from heating block with test tube holder.

(6) Carefully remove waterbath from alcohol burner and set aside.

(7) Heat test tube directly over flame for 1 minute.

(8) Remove from flame and cool.
(9) When tube has cooled to touch, add 2 drops of REAGENT 29 and observe color change.

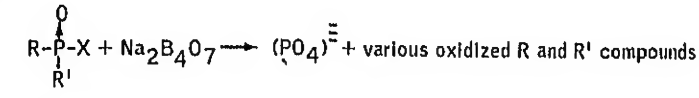
b. Interpretation.

(1) Positive Test. A red-brown or tan color, with or without a precipitate. If test is positive and TEST 16 is negative, the presence of the hetero element phosphorous is confirmed. The presence of hydrolyzable fluoride is not confirmed even if this test and TEST 13 are both positive.

(2) Negative Test. Yellow, blue, or colorless solution or a gray precipitate indicates a negative test. If TEST 13 is positive and this test is negative, the presence of hydrolyzable fluoride is confirmed.

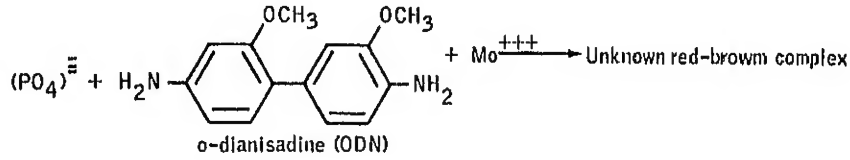
c. Chemical Reaction.

(1)



V or G-type agent

(2)



o-dianisadine (ODN)

d. Discussion.

(1) The hetero element phosphorous of an organic compound is converted to phosphate under combustion conditions. The phosphate ion is then detected by REAGENT 29 (molybdenum-O-dianisidine reagent).

(2) The blue color that may appear in the reagent or in the test tube is caused by the oxidation of the O-dianisidine.

(3) Silicates, heavy metals such as Fe, As, and Bi; WP and a high concentration of arsenicals will also give positive tests.

(U) TEST 16 (ODN-Molybdate)

Perform this test if TEST 15 is positive.

General Test for phosphate, silicate, and some heavy metals.

Specific Test for phosphate.

a. Procedure.

(1) Perform a blank test with this test. The blank test will be colorless or yellow. Follow procedures (1) through (5) as given in TEST 14.

(2) Add 2 drops of REAGENT 29.

b. Interpretation.

(1) Positive Test. Red-brown color, with or without a precipitate.

(2) Negative Test. A yellow, blue, or a colorless solution indicates a negative test.

c. Chemical Reaction. See Chemical Reaction (2) in TEST 15.

d. Discussion.

(1) This test must be performed if TEST 15 is positive to determine whether the $(PO_4)^{\equiv}$ was present before combustion.

(2) The interferences listed in the discussion of TEST 15 apply to this test.

Section IV (C). SMOKE OR AEROSOL TESTS (U)

3–9. (U) General

If a colored smoke was disseminated with the toxic smoke or aerosol, it may be difficult and in some cases impossible to perform smoke or aerosol tests.

a. TESTS 17 through 26, smoke or aerosol tests are described in this section. TESTS 17 through 25 are performed on cut sections of an exposed combination filter and TEST 26 is performed on an exposed Dragendorff paper.

b. Before performing tests on the combination filter, benzene-extractable smokes or aerosols must be separated from water soluble smokes or aerosols. To perform the separation:

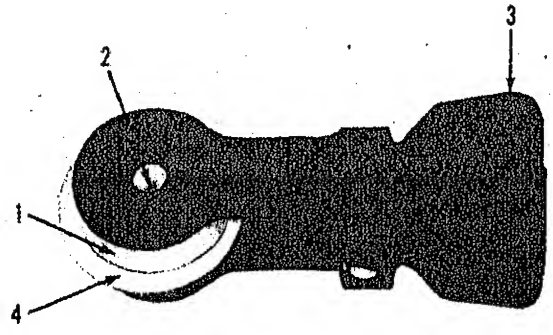
(1) Squeeze the squeeze lever (3, fig. 3–7) and place and center the exposed combination filter (14) between the clamping surfaces of the smoke extractor.

(2) Squeeze about 10 drops of benzene from the benzene syrette into the opening (2) in the upper clamp (1) of the smoke extractor.

(3) Waft the smoke extractor to speed the evaporation of the benzene.

(4) Add about 5 drops of benzene (just enough to barely wet the outer edge of the outer ring of the filter) and repeat (3) above.

(5) Remove the combination filter from the smoke extractor, separate the outer ring from the center disk, and place each one under a wood clip on the tray.



1 Upper clamp
2 Opening
3 Squeeze lever
4 Combination filter

Figure 3–7 (U). Smoke extractor (U).

c. Each test is performed on a fresh section of the combination filter and sections are cut as needed.

d. TESTS 17 through 19 (Group I) and TESTS 20 and 21 (Group II) are benzene-extractable smoke or aerosol tests which are performed on sections

of the outer ring (cellulose fiber) of the combination filter. Group I tests are performed to detect and identify arsenicals. Group II tests are performed to detect and identify alkylating and acylating-type agents. Color formation on outer ring sections usually appear as a narrow band along its outer edge.

e. TESTS 22 through 25 are water soluble smoke or aerosol tests which are performed on sections of the center disk (glass fiber) of the combination filter to detect and identify native proteins, high molecular weight alkaloids, heavy metals and organic insoluble arsenicals. Color formation on sections of the disk will appear wherever the reagent is applied. The color may appear as a solid spot, or as a ring with a lighter color, or no color in the center (preferential solubility effect).

f. TEST 26 is a smoke aerosol test to detect tertiary amines, quaternary ammonium salts, alkaloids, thioamides, and some secondary amines, heavy metal salts, and arsenicals.

g. When performing TESTS 18 through 21 and TEST 25 use the following basic procedure:

(1) Use the knitting needle to insert a test section into the test tube so that half of the test section extends from the tube.
(2) Apply required reagent to the test section.
(3) Gently slide the test section to the bottom of the tube with the needle.
(4) Place the tube in the heating block (alcohol burner) and heat as directed.
(5) Using the needle bring the test section up to the top of the tube.
(6) Withdraw test section with the coated tip forceps.
(7) Add additional reagent 18 required, in the test and observe the color change.

Note. Do not discard test tubes after use. Set them aside and clean them after all tests are completed (para 4–2).

3–10. (U) Group I Smoke or Aerosol Tests (TESTS 17 through 19)

Table III is an evaluation of Group I test results and the conclusions that can be drawn.

Table III (U). Evaluation of Group I Test Results (U).

TEST 17	TEST 18	TEST 19	Agent(s) in sample
Positive (tan color)	Positive	Negative	DC, possibly DA
Positive (tan color)	Positive	Positive	DC, DM, possibly DA
Positive (tan color)	Negative	Positive	DM, possibly DA
Positive (tan color)	Negative	Negative	DA
Positive (red color)	Positive	Negative	PD, DC, and possibly DA
Positive (red color)	Positive	Positive	PD, DC, DM, and possibly DA
Positive (red color)	Negative	Positive	PD, DM, and possibly DA
Positive (red color)	Negative	Negative	PD and possibly DA

(U) TEST 17 (DBT-Benzene)

General Test for arsenicals and heavy metal salts.
Specific Test for DC, DA, DM, and PD.

a. Procedure. Add REAGENT 14 to a section of the outer ring and observe color change.

b. Interpretation.

(1) Positive Test.

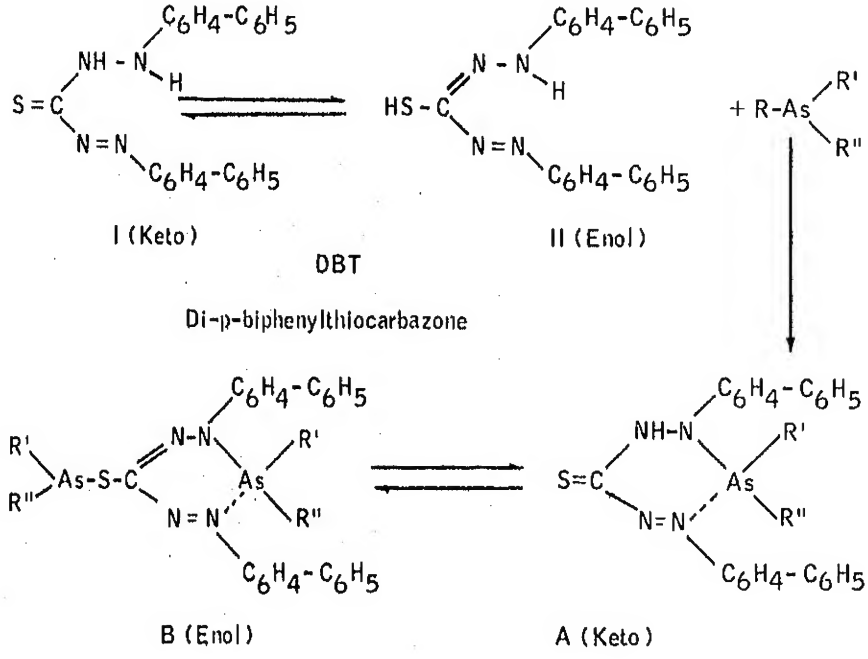
(a) Tan, light orange-brown, or yellow-orange color indicates the presence of DM, DC, DA, and DA-oxide, singly or in combination, and the absence of PD or PD-oxide.

(b) Pink or red color indicates the presence of PD or PD-oxide.

Note. Because the red color can readily mask any of the above colors DM, DC, DA, and DA-oxide, singly or in combination, may also be present. If a positive test is obtained, perform TESTS 18 and 19.

(2) Negative Test. Grey-green, blue-green, blue, or green and pale yellow color is a negative test. (See discussion.) If the test is negative, omit TESTS 18 and 19.

c. Chemical Reaction.



Colored Complex

Where: R= Cl, CN,OH
R' = Cl, OH, methyl. ethyl, phenyl
R" = Methyl, ethyl, phenyl

It is believed that the DBT-arsenical complex exists in either the A (keto) or B (enol) form. (The terms keto and enol are not quite correct in this case, but they serve to differentiate between the two forms). The composition of the complex depends on the concentration of the arsenical and the nature of R' and R". If the concentration is high and R' and R" have the ability to activate the As-Cl bond, the arsenical reacts with Form II DBT (enol) in addition to Form I DBT (keto). Thus:

DBT (Form I): Arsenical (1:1) = A

DBT (Form II): Arsenical (1:2) = B.

d. Discussion.

(1) The arsenicals are separated from heavy metal salts by the benzene extraction before the test is performed because the heavy metal salts will produce color reactions with DBT.

(2) DM, which is not very soluble in benzene, may give a false positive test for heavy metals during TEST 24.

(3) Because a specific test for DA is not included in the test, its presence must be suspected if a positive test for PD-oxide is observed.

(4) Color changes should be observed as soon as possible after the DBT has been applied to the test section because exposure to air or direct sunlight for as little as 5 minutes may produce an unsatisfactory test.

(5) Although the combination filter does not readily absorb and retain vapors the following vapors will give tests if present on the filter.

(*a*) Certain volatile bases such as ammonia, piperidine, and triethylamine give positive test colors ($_{p}$H effect).

(*b*) High concentrations of MD, L, and ED give pink color tests.

(*c*) Cl_2, oxides of nitrogen, diphosgene, CG, and bromoacetone will bleach the gray-green color to yellow. CK will give a negative test. PS and CN on standing (5–15 minutes) may produce a dull pink color.

(U) TEST 18 (Prussian Blue)

General Test for hydrolyzable Cyanide ion (CN^-) (GA, DC, AC, CK, etc.).
Specific Test for DC (diphenylcyanoarsine).

a. Procedure.

(1) Place a section of the outer ring in a test tube and add REAGENT 12.

(2) Heat for 1 minute.

(3) Add REAGENT 15.

(4) After 1 minute add REAGENT 16 and heat for 2 minutes. Repeat until the brown or green color disappears or a blue color is formed.

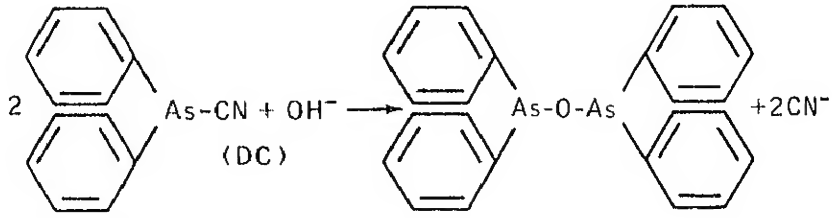
b. Interpretation.

(1) Positive Test. Blue color indicates presence of DC or (CN^-). (See discussion.)

(2) Negative Test. No blue color.

c. Chemical Reaction.

(1)



(2) $6\ CN^- + Fe(OH)_2 \longrightarrow Fe\left[(CN)_6\right]^{+4} + 2\ OH^-$

(3) $\left[Fe(CN)_6\right]^{+4} + Fe^{+++} \longrightarrow Fe_4\left[Fe(CN)_6\right]_3$

Prussian blue

d. Discussion. High concentrations of AC, GA, and CK, etc., if absorbed on the combination filter, will give positive tests because this test is a general test for hydrolyzable cyanide (CN^-).

(U) TEST 19 (DM)

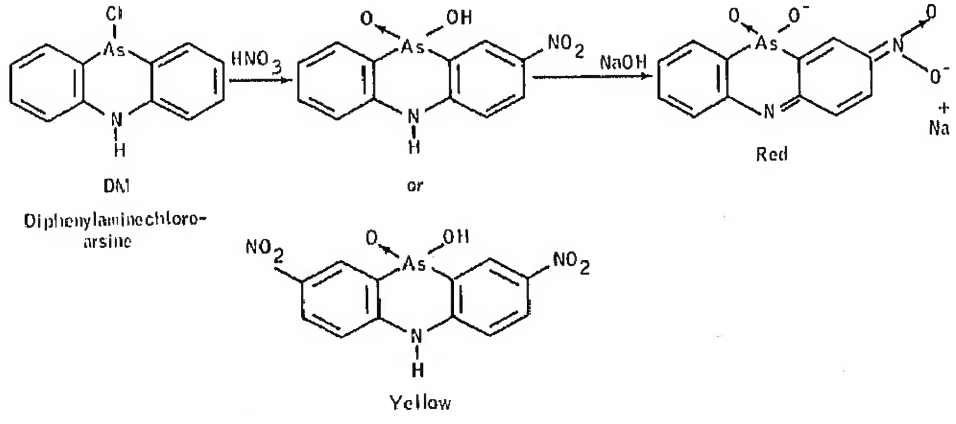
Specific Test for DM.

a. Procedure.

(1) Place a section of the outer ring in a test tube and add REAGENT 17.

(2) Negative Test. Any color other than that of positive.

c. Chemical Reaction.



d. Discussion. The normal color for a positive test is a red or a dark red-black, however, when the concentration of DM is very high, a yellow color may be produced. If DM is present in sufficiently high concentration, a momentary green coloration may be produced after REAGENT 17 is applied. The green color fades to a yellow or brown color after heating.

3–11. (U) Group II Smoke or Aerosol Tests (TESTS 20 and 21)

(U) TEST 20 (DB3-NH_4OH)

General Test for alkylating and acylating agents (see TEST 4).
Specific Test for CN, H-sulfone, Q, and T.

a. Procedure.
   (1) Place a section of the outer ring in a test tube and add REAGENTS 18 and 19.
   (2) Heat for 3 minutes.
   (3) Add REAGENT 19 and observe the color change.

b. Interpretation.
   (1) Positive Test. (If test is positive, perform TEST 21.)
      (a) A blue or purple-blue color indicates the presence of CN, H-sulfone, Q, or T-agents (see discussion).
      (b) A brown-peach or tan color indicates the presence of a mixture of CN and H-sulfone (see discussion).
   (2) Negative Test. (If test is negative, omit TEST 21.) No color change or a color change other than above is a negative test for CN, H-sulfone, Q, or T. (See discussion.)

c. Chemical Reaction. See TEST 4 for reaction mechanism. The mechanism for the formation of the brown-peach or tan color for the mixture of CN and H-sulfone is unknown, but it is believed that the color formation is due to an impurity in the toxic smokes.

d. Discussion. See TEST 4 for detail discussion. The combination filter does not readily absorb and retain certain vapors which are discussed in TEST 4. If the concentration of the vapors is high and the vapors are retained by the filter, the test colors listed in TEST 4 will apply for this test.

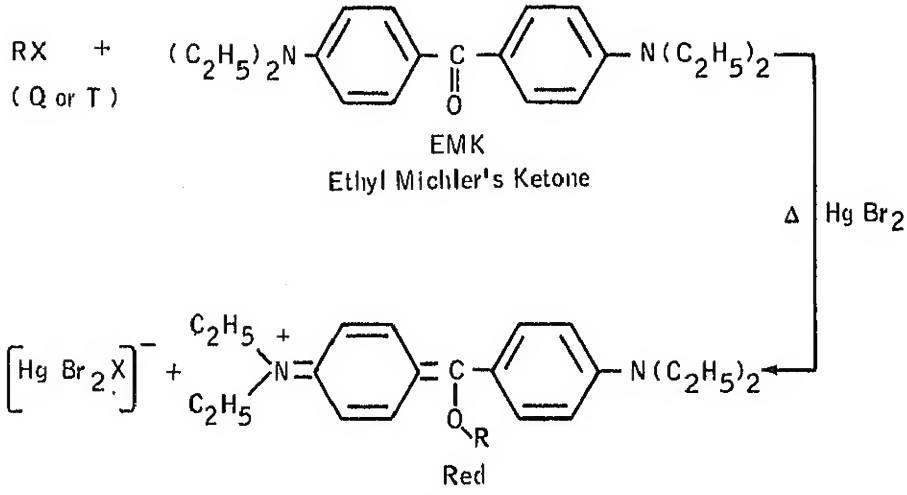
(U) TEST 21 (EMK)

General Test for strong alkylating and acylating agents.
Specific Test for Q and T.

a. Procedure.
   (1) Place a section of the outer ring in a test tube and add REAGENT 20.
   (2) Heat for 2 minutes and observe the color change.

b. Interpretation.
   (1) Positive Test. Red or red-brown color.
   (2) Negative Test. No color change or a color other than red or red-brown is a negative test.

c. Chemical Reaction.



d. Discussion. Q and T agents are mustard-type compounds which may be considered as alkylating agents. HD and HN will give positive tests if high concentrations are absorbed or retained on the combination filter, however, this is unlikely. CN and H-sulfone do not give a test.

3-12. (U) Water Soluble Smoke or Aerosol Tests (TESTS 22 through 25)

(U) TEST 22 (Proteins)

General Test for native proteins and high molecular weight alkaloids.
Specific Test for W (Proteins).

a. Procedure.

(1) Add REAGENT 26 to a section of the center disk and observe the color.

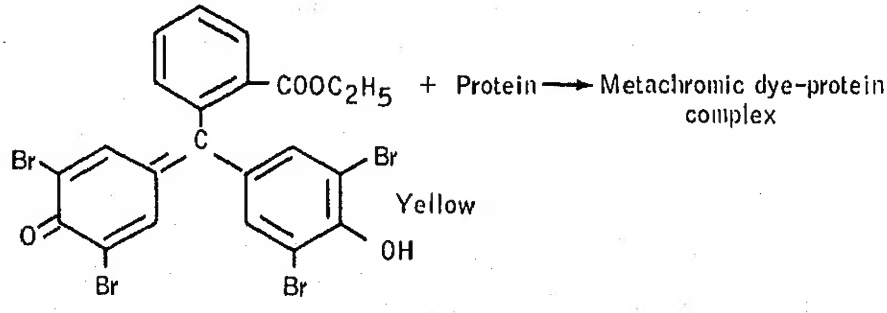
(2) Apply enough REAGENT 25 to wet whole test section (2 or 3 drops) and observe the color change.

b. Interpretation.

(1) Positive Test. A persistent blue-green color indicates the presence of W agent or protein. (See discussion.)

(2) Negative Test. Any color other than blue-green is a negative test.

c. Chemical Reaction.



Tetrabromophenolphtaleinethylester

d. Discussion.

(1) This test is specific for native proteins. Protein hydrolysis products such as amino acids, dipeptides, and peptones do not react with the ester.

(2) High concentrations of alkaloids of high molecular weight may give a color test similar to that of the native proteins. The alkaloid reaction is ascribed to the formation of adsorption compounds of colloidally dispersed alkaloids which are resistant to acetic acid.

(3) The following is a partial list of native proteins that can be detected:

Egg albumin	Serum albumin	Edestin	Salmin
Hemoglobin	Casein	Clupein	Gliadin

(U) TEST 23 (Cadion 2B)

General Test for cadmium and magnesium ion.

Specific Test for cadmium ion.

a. Procedure.

(1) Add REAGENT 22 to a section of the center disk and evaporate the solvent.

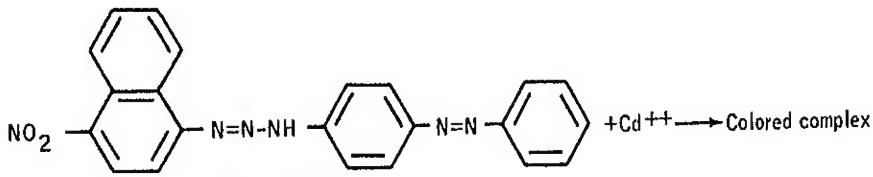
(2) Add REAGENT 12 and observe the color change.

b. Interpretation.

(1) Positive Test. A pink color is a positive test.

(2) Negative Test. A blue or purple-blue color indicates the absence of cadmium ion.

c. Chemical Reaction.



Cadion 2B

4-Nitronapthalene-diazoaminobenzene-4'azobenzene

d. Discussion. High concentrations of strong acid or base may vary the negative test (blue or purple-blue). High concentrations of magnesium ion in the sample will give positive tests.

(U) TEST 24 (DBT-H_2O)

General Test for heavy metals and arsenicals.

Specific Test for heavy metals such as Cd, Zn, As, Bi, Hg, Sb, and Se.

a. Procedure.

(1) Add REAGENT 14 to a section of the center disk.

(2) Allow the solvent to evaporate and observe the color change.

b. Interpretation.

(1) Positive Test. A pink, violet, purple, blue-violet, red-violet or straw-yellow color indicates the presence of heavy metal ions.

(2) Negative Test. A grey-green or blue-green color indicates the absence of heavy metal ions.

c. Chemical Reaction. The reaction mechanism is the same as the DBT test for arsenicals (TEST 17). The color of the metal complex will vary depending on the metal ion present and the number of DBT molecules in the metal complex.

d. Discussion.

(1) As indicated in TEST 17, if DM is present in the sample, some of it may remain on the center disk and will interfere with the heavy metals test. In general, all interferences discussed in TEST 17 apply to this test.

(2) Test colors will vary in shade and intensity depending on the concentration of the metal salt. A partial list of colors that may be expected with metal salt follows:

Ion	*Color*
Cd^{++}	Pink or violet
Fe^{+++}	Pink
Zn^{++}	Pink or violet
As^{+++}	Pink, purple, or violet
Hg^{++}	Pink or purple
Bi^{+++}	Pink or blue-violet
Sb^{+++}	Pink or red-violet
Se^{++}	Straw yellow

(U) TEST 25 (SeO_2)

Specific Test for SeO_2.

a. Procedure.

(1) Place a section of the center disk in a test tube and add REAGENT 21.

(2) Heat to dryness.

(3) Remove the test tube from the heating block and observe the color change.

b. Interpretation.

(1) Positive Test. Orange-red or orange-brown color.

(2) Negative Test. No color change or a color other than that of a positive test indicates the absence of SeO_2.

c. Chemical Reaction.

$$SeO_2 + NH_2OH \rightarrow Se\downarrow + HNO_2 + H_2O$$

d. Discussion. This test is specific for SeO_2. No other agent will give a positive test. Other metal salts may be reduced by hydroxylamine, but they will produce color changes other than that of the positive test for SeO_2.

3-13. (C) Dragendorff Smoke or Aerosol Test (TEST 26)

(C) TEST 26 (Dragendorff Paper)

General Test for tertiary amines, quaternary ammonium salts, alkaloids and thioamides, some secondary amines, heavy metals salts and arsenicals.

Specific Test for V-agents (containing tertiary amines), GA and nitrogen mustards (HN).

a. Procedure. Wet the exposed Dragendorff paper with REAGENT 27 (water) and observe the color change within 1 minute.

b. Interpretation. See TEST 6.

c. Chemical Reaction. See TEST 6.

d. Discussion. Dragendorff paper as used with the multiple sampling head will collect CW-agents disseminated as smoke or aerosols.
(C) The paper does not readily absorb vapors such as HN, however, if vapors such as HN are present in very high concentration, they will give positive test. See Discussion (TEST 6).

Section V. (C) SOIL EXTRACT AND WATER TESTS (U)

3–14. (U) General

a. The soil extract and water tests provide information for tactical purposes. When additional information is required for strategic purposes, send unused portions of soil extract and water samples forward to a base laboratory for further analysis.

b. The soil extract contains CW-agents and chemicals that are soluble in ligroine (soil extraction fluid). It is not likely that the soil extract will contain water-soluble tonics.

c. The water sample may contain CW-agents, the hydrolysis products of some CW-agents, and dissolved chemicals other than CW-agents.

d. Due to interferences from other chemicals and the solvent dilution of the samples, tests performed on soil extract and water samples are usually less sensitive than the tests on vapor samples. In some cases, it may be necessary to concentrate the samples to obtain satisfactory test results. A soil extract can be readily concentrated by evaporating the solvent before performing the test. The rate of evaporation of water from the water sample should not be increased by heating because the elevated temperature may cause decomposition, hydrolysis, or volatilization of the CW-agent.

e. Vapor tests can be performed on a soil sample as an alternate method before the soil sample is processed (para 3–11).

f. Soil extract and water samples are transferred by means of capillary tubes in the kit.

3–15. (C) Soil Extract and Water Tests (TESTS 27 through 48) (U)

(U) TEST 27 Anti-ChE (Enzyme)

General Test for Anti-ChE material (phosphoro, phosphono, quaternary ammonium salts and carbamates).
Specific Test for G and V type agents.

a. Procedure.

(1) Perform Steps 1 and 2 of Figure 2–2.
(2) Add 1 to 2 drops of sample to the square end of the ticket.
(3) For soil extract sample, allow solvent to evaporate. (Omit this step when testing water sample.)
(4) Perform the remaining steps, omitting step 7.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 1.

(U) TEST 28 (CK)

General Test for highly reactive alkylating and acylating Agents (carbonium ion formation).
Specific Test for cyanogen chloride (CK).

a. Procedure. Add 2 to 3 drops of sample to an unexposed BLUE BAND TUBE and observe the color change.

b. Interpretation. Chemical Reaction, and Discussion. See TEST 2.

(U) TEST 29 (Schoenemann Reaction)

Perform this test only if TEST 27 is positive and TEST 28 is negative.
General Test for compound that forms perphosphonate ions and pericids, and strong oxidizing agents.
Specific Test for G-type agents (GA, GB, etc.).

a. Procedure.

(1) Transfer 5 drops of the sample to a spot plate.
(2) Add REAGENT 3 and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 3.

(U) TEST 30 (DB3)

Perform this test only if TEST 27 and TEST 28 are negative.
General Test for alkylating and acylating agents.
Specific Test for mustard (HD, HN), phosgene oxide (CX), Q, T, CN, and H-sulfone.

a. Procedure.

(1) Add 5 drops of the sample to a test tube.
(2) Add 2 drops of REAGENT 18 followed by 1 drop of REAGENT 19.
(3) If there is no color change, heat for 2 minutes.
(4) Cool, add 1 drop of REAGENT 19 and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TESTS 4 and 20.

(U) TEST 31 (DB3–SO_3)

Perform this test only if TESTS 28 and 30 are negative.
Specific Test for chloropicrin (PS).

a. Procedure.

(1) Transfer the gel from an unexposed BLUE BAND TUBE to a test tube (or spot plate) as shown in figure 3–4.
(2) Add 5 drops of sample.
(3) Add REAGENT 24 and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 5.

(C) TEST 32 (Dragendorff) (U)

General Test for tertiary amines, quaternary ammonium salts, alkaloids, thioamides, some secondary amines, heavy metal salts and arsenicals.

Specific Test for V-agents (containing tertiary amine), GA and nitrogen mustards (HN).

a. Procedure.

(1) Cut a Dragendorff paper into two pieces.
(2) Add 2 or 3 drops of soil extract to one piece.
(3) Allow solvent to evaporate.
(4) Add 1 or 2 drops of REAGENT 27 (water) and observe the color change.
(5) Add 2 or 3 drops of water sample to second piece of paper and observe color change.

Alternate Procedure.

(1) Transfer 3 to 5 drops of the sample (soil extract or water) to a spot plate.
(2) Add 2 drops of REAGENT 7 and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 6.

(U) TEST 33 (Acetylide)

General Test for compounds which liberate acetylene on addition of base.

Specific Test for Lewisite (L) and L-oxide.

a. Procedure.

(1) Transfer the gel from an unexposed DOUBLE YELLOW BAND tube to a test tube (or spot plate) as directed in figure 3-4.
(2) Add 3 to 5 drops of sample.
(3) Add REAGENT 12 and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 8.

(U) TEST 34 (PDB-PAN)

General Test for acylhalides.

Specific Test for phosgene (CG).

a. Procedure. Add sufficient sample to wet the gel in an unexposed SINGLE GREEN TUBE and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 9.

(U) TEST 35 (Tetra Base)

(Perform this test only on soil extract.)

General Test for cyanide, cyanogen, and strong oxidizing agents.

Specific Test for hydrogen cyanide (AC).

a. Procedure. Add sufficient sample to wet the gel in an unexposed RED BAND TUBE and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 10.

(U) TEST 36 (DNB)

General Test for carbanion.

Specific Test for CN and BBC.

a. Procedure.

(1) Transfer the gel from an unexposed DOUBLE GREEN BAND TUBE to a test tube (or spot plate) as directed in figure 3–4.

(2) Add 3 to 5 drops of sample and allow solvent to evaporate.

(3) Add 1 drop of REAGENT 12 and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 11.

(U) TEST 37 (Pyrazolone)

(Perform this test only if TEST 27 and 29 indicates the presence of Anti-ChE agent and TEST 28 is negative.)

General Test for hydrolyzable cyanide.

Specific Test for GA (CN^-).

a. Procedure.

(1) Transfer 3 to 5 drops of the sample to a test tube.

(2) Add 1 drop of REAGENT 10 and REAGENT 11 and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 12.

(U) TEST 38 (Alizarin Lake)

(Perform this test only if TESTS 27 and 29 indicate presence of Anti-ChE agent and then only on the soil extract.)

General Test for hydrolyzable fluoride (F^-) and phosphate.

Specific Test for GB-type agent (F^-).

a. Procedure. Blank must be run. This test must be run currently with TEST 41.

(1) Transfer 3 to 5 drops of soil extract to a test tube.

(2) Follow procedure (2) through (8) described in TEST 13 for both the sample and the blank.

b. Interpretation.

(1) Positive Test. The sample is yellow and the blank is pink. The presence of fluoride ion (F^-) is confirmed if TEST 41 is negative. If both TEST 27 and TEST 29 indicate the presence of Anti-ChE agent, and this test is positive, the agent is of the -P-halogen and not -P-CN type.

(2) Negative Test. If both the blank and the sample are pink, the test is negative.

c. Chemical Reaction and Interpretation. See TEST 13.

(C) TEST 39 (Tertazolium) (U)

(Perform this test only if TEST 27 indicates presence of Anti-ChE agent and TEST 29 is negative.)

General Test for mercaptans, hydrolyzable thioesters, and strong reducing agents.

Specific Test for mercaptans for identification of V-agents.

a. Procedure.
(1) Transfer 3 to 5 drops of sample to a test tube.
(2) Follow procedure (3) through (8) as described in TEST 14.
b. Interpretation.
(1) Positive Test. A red or purple-brown color.
(2) Negative Test. A yellow or yellow-brown color.
c. Chemical Reaction and Discussion. See TEST 14.

(U) TEST 40 (ODN—Molybdenum Peroxide)

(Perform this test only on the soil extract if TEST 27 indicates the presence of agent, or for the general identification of organophosphorous compound.)
General Test for PO_4 from organophosphorous compounds, silicates, and some heavy metals.
Specific Test for organophosphorus as phosphate (PO_4).
a. Procedure.
(1) Transfer 5 drops of soil extract to a test tube.
(2) Evaporate the contents to dryness in the heating block.
(3) Remove the test tube and allow it to cool (30-60 seconds).
(4) Follow the procedure (2) through (9) as described in TEST 15.
b. Interpretation, Chemical Reaction, and Discussion. See TEST 15.

(U) TEST 41 (ODN-Molybdate)

(Perform this test if TEST 40 is positive.)
General Test for phosphate, silicates, and some heavy metals.
Specific Test for phosphate.
a. Procedure.
(1) Perform a blank test with this test. Add 5 drops of the soil extract to a test tube.
(2) Evaporate to dryness in heating block.
(3) Allow test tube to cool to touch.
(4) Add 2 drops of REAGENT 29 and observe color change.
b. Interpretation.
(1) Positive Test. Red-brown color with or without a precipitate.
(2) Negative Test. A yellow, blue, or colorless solution indicates a negative test.
c. Chemical Reaction. See reaction (2), TEST 15.
d. Discussion.
(1) This test must be performed if TEST 40 is positive.
(2) Interferences listed in the discussion of TEST 15 apply to this test.

(U) TEST 42 (DBT)

General Test for arsenicals and heavy metal salts.
Specific Test for L, L-oxide, ED, PD, PD-oxide, MD, DM, DC, DA, and heavy metal salts.
a. Procedure.
(1) Using coated tip forceps, tear off one inch of paper from the paper dispenser.

(2) Add 2 or 3 drops of sample to the paper and place it in a test tube.
(3) Evaporate the solvent to dryness.
(4) Repeat the above procedure two additional times to increase concentration of the sample on the paper.
(5) Add REAGENT 14 and observe color change.

b. Interpretation. See TESTS 17 and 24 for interpretation of the test. L, L-oxide, MD, and ED will also be detected and usually give pink or red color tests.

c. Chemical Reaction. (See TESTS 17 and 24.)

d. Discussion. Organo-metallic compounds of heavy metals that are soluble in nonpolar solvents will also give positive tests. Because most arsenicals hydrolyze rapidly in water, water samples may not give positive tests for arsenicals but only detect the heavy metals. (See TESTS 17 and 24.)

(U) TEST 43 (DM)

Specific Test for DM.

a. Procedure.
(1) Using the coated tip forceps, tear off one inch of paper from the paper dispenser.
(2) Add 2 or 3 drops of sample to the paper and place the paper in a test tube.
(3) Add REAGENT 17 and heat 2 minutes.
(4) Add REAGENT 12 and observe color change.

b. Interpretation.
(1) Positive Test. Dark red, red-black, or yellow color. See discussion, TEST 19.
(2) Negative Test. Any color change than that of a positive test.

(U) TEST 44 (EMK)

General Test for alkylating and acylating agents.
Specific Test for Q, T, HD, HN, CN, and H-sulfone.

a. Procedure.
(1) Using the coated tip forceps, tear off one inch of paper from the paper dispenser.
(2) Add 2 or 3 drops of sample to the paper and place the paper in a test tube.
(3) Add REAGENT 20 and heat for 2 minutes.
(4) Observe the color change.

b. Interpretation. (See TEST 21.) Under the conditions prescribed for this test, HD and HN will also give positive tests.

c. Chemical Reaction and Discussion. See TEST 21.

(U) TEST 45 (Cadion 2B)

(Perform this test only on water samples.)
Specific Test for Cadion.

a. Procedure.
(1) Using the coated tip forceps tear off one inch of paper from the paper dispenser.

(2) Add 2 or 3 drops of sample to the paper.
(3) Add REAGENT 22 and allow solvent to evaporate.
(4) Add REAGENT 12 and observe the color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 23.

(U) TEST 46 (NH_2OH)

(Perform this test only on water samples.)
Specific Test for SeO_2.

a. Procedure.
(1) Using the coated tip forceps tear off one inch of paper from the paper dispenser.
(2) Place the paper in a test tube.
(3) Add 2 to 3 drops of the sample to the paper.
(4) Add REAGENT 21 and heat to dryness.
(5) Remove and observe color change.

b. Interpretation, Chemical Reaction, and Discussion. See TEST 25.

(U) TEST 47 (pH)

(Perform this test only on water samples.)

a. Procedure.
(1) Transfer 10 drops of the sample to a spot plate.
(2) Add REAGENT 13 and observe the color change.

b. Interpretation.
(1) A yellow color indicates that the sample is acidic.
(2) A green color indicates that the sample is neutral.
(3) A green-blue color indicates that the sample is alkaline.

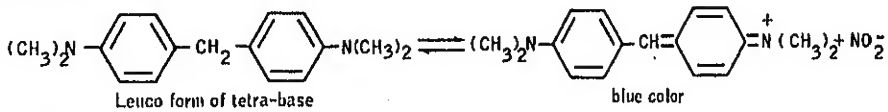
(U) TEST 48 (NO_2)

(Perform this test only on water samples.)
General Test for strong oxidizing agents.
Specific Test for oxides of nitrogen.

a. Procedure.
(1) Add 5 drops of the sample to a spot plate.
(2) Add REAGENT 23 and observe the color change.

b. Interpretation.
(1) Positive Test. A blue color indicates the presence of oxidizing agents in the sample.
(2) Negative Test. No color change indicates the absence of oxidizing agents in the sample.

c. Chemical Reaction.



Leuco form of tetra-base — blue color

A strong oxidizing agent in acid solution is required to oxidize the leuco form.

d. Discussion. See TEST 10.

CHAPTER 4 (U)

CLEANING AND EMERGENCY DECONTAMINATING

4–1. General

a. Because of space limitations in the kit, test tubes may be in short supply and may have to be cleaned and reused. Discard test tubes only when they appear dirty or discolored after repeated cleaning.

b. Small surfaces such as the ends of the plastic needle, the tips of the specimen jar forceps and the coated tip forceps, the clamping surfaces of the smoke extractor and the wood clips, and the front face of the air sampler, may become contaminated and require emergency decontamination.

4–2. Cleaning Used Test Tubes

Clean used test tubes as described below:

(1) Remove the test papers and discard the liquid from the used test tubes.
(2) Rinse each test tube with clean water.
(3) Using the cotton-tipped end of an applicator, scrub the inside of the test tubes with soapy water or with a few drops of REAGENT 12 (10% NaOH). (If possible, boil the test tubes in soapy water for 15 minutes.)
(4) Rinse each test tube several times with clean water.
(5) Rinse each test tube with a few drops of REAGENT 6 (alcohol).
(6) Examine the test tubes. If a test tube appears discolored or dirty, repeat above cleaning procedure.
(7) If after a second cleaning, the test tube is still discolored or dirty, discard it.

4–3. Emergency Decontamination of Small Surfaces

In an emergency, decontaminate the small surfaces that may have come in contact with CW or BW-agents as described below:

a. Scrub the surfaces with a swab wet with a few drops of REAGENT 12 (10% NaOH).

b. Rinse several times with clean water.

c. Scrub the same surfaces with a second swab wet with a few drops of REAGENT 6 (alcohol).

APPENDIX I (C)

SENSITIVITY SUMMARY (U)

Table IV (C) Summary of Tests for Known CW-Agents in Terms of Relative Sensitivity, by Test Number and CW-Agent

AGENT / TEST NO.	V	GA	GB	GK	HD	HN	CX	PS	L	ED	MD	CG	AC	CK	BBC	DA	DC	DM	FD	M-Sulfone	Q	T	W	Cd	Heavy metals	SeO_2
1 (Enzyme)	4	4	4																							
2 (CK)				2											*											
3 (Schoenemann Reaction)		3	3	3*																						
4 (DBJ-NaOH)				3*	3	3	3	*				*		1*						1*	1*	1*				
5 ($DBJ-SO_3$)				3*	2*	2	2*	3		*		*		*						*	*	*				
6 (Dragendorff)	2	2			*	2			*	*	*					*	*	*	*							
7 (Molybdenum Blue)									2	3	3					*	*	*	*							
8 (Acetylide)							*		3																	
9 (FDB-FAN)				*				*				3														
10 (Tetra-Base)		3*		*			*			*			3				3*									
11 (DNB)										*	*			3	3											
12 (Pyrazolone)		3											*					*								
13 (Alizarin Lake)			2						*	*	*															
14 (Tetrazolium)	2																									
15 (ODH-Molybdate-Peroxide)	2	2	2																						*	
16 (ODH-Molybdate)																									*	
17 (DBT-Benzene)									3*	3*	3*					3	3	3	3					3*	3*	2*
18 (Prussian Blue)		2*											*				2									
19 (DM)																		3								
20 ($DBJ-NH_4OH$)				2*	2*	2*	*	*				*		3						2	3	3				
21 (EMK)				*	2*	2*															3	3				
22 (Proteins)																							3			
23 (Cadion 2Bl)																								3	*	
24 ($DBT-H_2O$)									*	*	*					*	*	*	*					3	3	3
25 (NH_2OH)																									*	3

Note: Relative Sensitivity in Gamma/liter

4 = 0.01 to 0.1 2 = 10 to 50

3 = 0.1 to 10 1 = 50 to 100

*Interference - See discussion of specific test.

APPENDIX II (U)

REFERENCES

SC 6665-94-CL-E03	Sets, Kits, and Outfits Components List Sampling and Analyzing Kit, CBR Agent, M19 (FSN 6665-776-8810).
TM 3-6665-205-10/1	Operator's Manual, Sampling and Analyzing Kit, CBR Agent, M19.

INDEX (U)

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NG: None.
USAR: None.
For explanation of abbreviations used, see AR 320-50.

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